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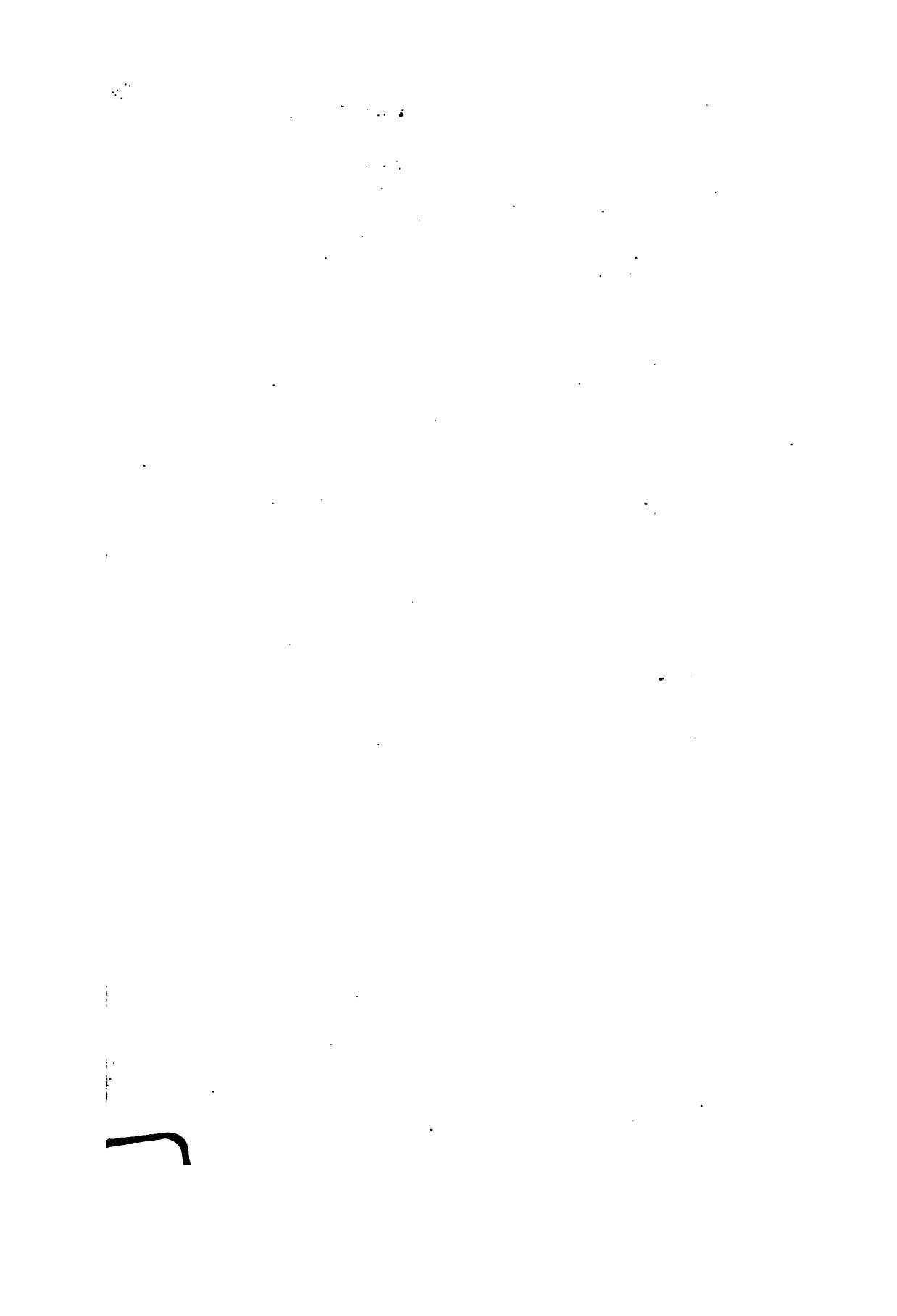
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BUNKER HILL MONUMENT, CHARLESTOWN, MASS.

# HISTORY OF THE GRANITE INDUSTRY OF NEW ENGLAND

X

BY

ARTHUR W. BRAYLEY

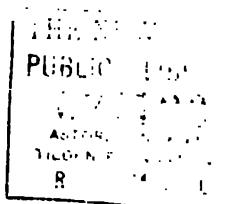
*Author of "Schools and Schoolboys of Old Boston"; "Bakers and Baking in Massachusetts"; "History of the Boston Fire Department"; etc.*



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**HISTORY OF THE GRANITE INDUSTRY  
OF NEW ENGLAND.**

**VOL. I.**



## INTRODUCTION

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HOWEVER much men may change from one generation to another in their lives of thought or in their modes of life, there is one respect in which human nature is ever the same. The heart does not change. It cries out in pain now when the shadow of death falls upon a loved one, just as it did when David gave utterance to his grief over the loss of his Absalom. But though love of kin is the same from generation to generation, and though there is a struggle to express that love by some memorial to the departed, the memorials change with changing thoughts and with changed circumstances.

We now are sensible how inappropriate, indecorous and almost unhallowed were the old burial grounds as they existed in past years. Human feelings, which have found life and expression in the experience of the more appropriate rural or garden cemeteries, would revolt from a return to interments within these unadorned and desolate burial places as they formerly existed.

Only the ingenuity of man is the limit to form in memorials for every large cemetery will furnish specimens that vary from the modest marker to the elaborate sculptured piece, the stately mausoleum, or to the bronze tablet fastened to a boulder.

But while unity cannot be predicted of the form, it is evident in the purpose, and this is true not only to the memorials of this generation, but of all generations since the resting place of the dead were marked at all.

ARTHUR W. BRAYLEY.

*Boston, January 1, 1913.*



## CHAPTER I.

INTRODUCTION OF GRANITE AS A BUILDING STONE INTO  
NEW ENGLAND.

“THE topography, the soils and other physical conditions of the region about Boston depend in a very intimate way upon the history of the district in which they lie,” says Professor N. S. Shaler, S.D.

The New England section of North America, viz., the districts cut off by the Hudson, Champlain and St. Lawrence valleys, is one of the most distinctly marked of all the geographical regions of the continent. In it we find a character of surface decidedly contrasted with that of any other part of the United States. While in the other districts of this country the soil and the contour of the surface are characterized by a prevailing uniformity of conditions, in this New England region we have a variety and detail of physical features that find their parallel only in certain parts of Northern Europe, whence came the New England colonists. This peculiarly varied surface of New England depends upon certain combinations of geological events that hardly admit of a very brief description. The main elements of the history are, however, as follows:

The New England district has been more frequently and perhaps for a longer aggregate time above the level of the sea than any other part of the region south of the Great Lakes. This has permitted the erosive forces to wear away the unchanged later rocks, thereby exposing over its surface the deep lying metamorphic beds on whose masses the internal heat of the earth has exercised its diversifying effects. This irregular metamorphism brings about a great difference in the hardness of the rocks, causing them to wear down by the action of the weather at very different rates. Then the mountain building forces—those that throw out of their original horizontal positions into altitudes of the utmost variety—have

worked upon this ground more than they have upon any other region east of the Cordilleros of North America. Again at successive times and especially just before the human period, and possibly during its first stages in this country, the land was deeply buried beneath a sheet of ice. During the last glacial period, and perhaps frequently during the recurrent ice times, of which we find traces in the record of the rocks, the ice sheet for long periods overtopped the highest of our existing hills, and ground away the rock surface of the country as it crept towards the sea. During the first stage of the last ice period this ice sheet was certainly over two thousand feet thick in Eastern Massachusetts, and its front lay in the sea at least fifty miles to the east of Boston. At this time the glacial border stretched from New York to the far North, in an ice wall that lay far to the eastward of the present shore, hiding all traces of the land beneath its mass.

These successive ice sheets rested on a surface of rock already much varied by the metamorphism and dislocations to which it had been subjected. Owing to the fact that ice cuts more powerfully in the valleys than on the ridges, and more effectually on the soft than on the hard rocks, this ice sheet carved this surface into an amazing variety of valleys, pits and depressions. We get some idea of the variety of these rock carvings from the fretted nature of the seacoast over which the ice sheets rode. When the last ice sheet melted away it left on the surface it had worn a layer of rubbish often a hundred feet or more in depth. As its retreat was not a route, but was made in a measured way, it often built long, irregular walls of waste along the lines when its march was delayed. When the ice wall left the present shore line, the land was depressed beneath the sea to a depth varying from about thirty feet along Long Island Sound to three or four hundred feet on the coast of Maine. The land slowly and by degrees recovered its position, but as it rose, the sea for a time invaded the shore, washing ever with its tides and waves the rubbish left by the ice sheet, stripping the low hills and heaping the waste into the valleys. While this work was going on the seas had not yet regained shore life, which had been driven away by the ice, and the forests had not yet recovered their power in the land, so the stratified deposits formed at this time contain no organic remains. At the close of this period when the land had generally regained its old position in relation to the sea, there were several slight, irregular movements of the shore—local risings and sinkings, each of a few feet in height. The last of

these were accomplished in Massachusetts not long before the advent of the European colonists. Some trace of their action is still felt on the coast to the northward.

This brief synopsis of the varied geological history of New England will enable us to approach the similarly brief history of the Boston district.

Looking on a detailed map of Southeastern New England, the reader will observe that Massachusetts Bay and Boston Harbor forms a deep but rudely-shaped re-entrant angle on the coast. If the map is geologically colored, he will perceive that around this deep bay there is a fringe of gray slates and conglomerates or pudding stones. Further away, making a great horseshoe, one horn, of which is at Cape Ann, and the other at Cohasset, the curve at its bottom near the Blue Hills includes a mass of granite rocks. This peculiar order of the rocks which surround Boston is caused by the existence here of a deep structural mountain valley or synclinal, the central part of which is occupied by the harbor. Long after the formation of the Green Mountains, at the time just after the laying down of the coal beds of the carboniferous age, this eastern part of New England, and probably a considerable region since regained by the sea, was thrown into mountain folds. These mountains have by the frequent visitations of glacial periods been worn down to their foundations, so that there is little in the way of their original reliefs to be traced. The Sharon and the Blue Hills are, however, the wasted remnants of a great articinal or ridge that bordered the Boston valley on the south side. The Waltham, Stoneham and Cape Ann Bay granitic ridges made the mountain wall on its north side. Narragansett Bay and Boston Harbor are cut in the softer rocks that were folded down between these mountain ridges. The larger part of the Merrimac valley is a mountain trough that has been similarly carved out, and there are others traceable still farther to the northward. This mountain trough is very deep beneath Boston. A boring made at the Gas Works to the depth of over sixteen hundred feet failed to penetrate through it.

Within the peninsula of Boston, the seat of the old town, these older rocks that were caught in the mountain folds do not come to the level of the sea. They are deeply covered by the waste of the glacial period. But in Roxbury, Dorchester, Somerville, Brookline, and many other adjacent towns they are extensively exposed. They consist principally of clay slates and conglomerates, a mingled series

with a total thickness of from five to ten thousand feet. The slates are generally fine grained and flaglike in texture, their structure showing that they were laid down in a sea at some distance from the shore. The conglomerates were evidently laid down in the sea at points near the shore, and they are probably the pebble waste resulting from a glacial period that occurred in the Cambrian age, or at a time when the recorded organic history of the earth was at its very beginning.

After the first settlers came to Boston, in 1630, they probably found the land upon which the city now stands covered with an abundant supply of New England boulders, which were at once useful in the construction of building, just as they are now used in the country districts, but it seems probable that no ledge of rock was found in the old town. Opinions differ, however, as to this point, for Judge Sewall in his diary mentions getting out building stones from the Common as late as 1693. There was the wishing stone near the junction of Beacon street mall, and the path leading to Joy street, and we are told "the young folks of by-gone days used to walk nine times around this stone, and then standing or sitting upon it silently make their wishes."

That they began at once to use stone for houses is shown in the following record: "October 30, 1630, a stone house which the governor was erecting at Mystic was washed down to the ground in a violent storm, the walls being laid in clay instead of lime." Mud houses were, indeed, known in the early days of the town, but these were very few in number, and, of course, were only occupied by the poorest of the colonists; or, more correctly speaking, by their menials only. A few houses were built of stone and some of brick, but these were exceptions to the general rule until Boston had become over twenty years of age. About 1650, Johnson says of the city, ". . . The buildings are beautiful and large, some fairly set forth with brick, tile, stone and slate."

There existed until 1864 a stone house built about that time (1650), which was early known as the "stone house of Ebenezer John Phillip," a worthy baker of the town, which stood on the east side of Cross street, between North and Hanover streets. It was built chiefly of the common rocks found in the native soil of the peninsula which were broken into various shapes and sizes and laid into place. The foundation walls were four feet thick; the walls above ground were two feet in thickness, and built entirely of small

quarried stones unlike anything to be seen in that neighborhood, and which were probably brought as ballast from some part of Europe. They were laid in clay mortar throughout. The upper story, which was a later addition, was built of English brick, and laid in lime mortar, and some of the circular windows had also been filled with the same material, new doors and windows having been opened through the thick stone wall. The stones which formed its walls were removed to form the underpinning of a Methodist Church in Saratoga street, East Boston.

But if there were various styles of architecture in the first buildings, the materials of which they were constructed were the same in all, save in a very few—heavy oaken frames, boarded over and covered with clapboards. Soon after the fire of 1679, buildings were of a new design. Wealth had increased and the Puritans began to pay more attention to the luxuries of life.

To make the houses fireproof they were coated with cement, small pebbles and broken glass. Brick houses, three stories in height, with arched window caps after the fashion of the day in London, came in vogue at the same time, especially in the more thickly settled portions of the town.

The style of laying bricks is a marking point denoting various periods of New England history. The first style was the old English bond, which consisted of courses of bricks laid lengthwise, alternating with others laying endwise. Then came the form which consisted of a row of bricks laid endwise after every seventh laid lengthwise. The Flemish bond style came after this, in which every row was laid with alternate bricks lengthwise and endwise so as to break joints neatly and preserve the bond. Then came the style in general use today, although one may find many of the old systems used by the architects of the present time.

But it was a fact well known to architects at the beginning of the nineteenth century that there was much difficulty at that time in obtaining suitable material for the construction of public or private buildings, especially for the decorative parts.

The red Connecticut sand stone was shipped to Boston very early. In 1665 ordinances were passed in Portland, Conn., relating to the use of the stone by outsiders, which seems to have been used in Boston within the first hundred years. Thus the old Province House, erected in 1679, is described as having a flight of twenty massive red freestone steps. The freestone used in 1737, in the

Hancock House, came from Middletown, Conn. In consequence of extensive fires, laws were passed in 1692 and 1699 concerning the construction of stone houses, that of 1692, decreeing "that henceforth no dwelling house in Boston shall be erected and set up except of stone and brick and covered with slate or tile." However, it was not enforced. The triangular building called the "Old Feather store" or the "Cocked Hat," which stood near North Market street, and was built about this time, had three turrets covered with slate. Slate was used very early for roofing and was probably in part imported from Wales and in part obtained in Massachusetts. Professor Shaler says on this point:

"From the slates and conglomerates of the Cambridge and Roxbury series the first quarried stones of this colony were taken. The flagging slates at Quincy at the base of Squantum Neck were perhaps the first that were extensively quarried. A large number of old tombstones of this region were from these quarries. The next in use were the similar but less perfect slates of Cambridge and Somerville; and last to come into use were the conglomerates or "pudding stone" and granites that require much greater skill on the part of the quarryman to work them. At first the field boulders supplied the stone for underpinnings of houses and other wall work, so that the demand for gravestones was during all the first and for most of the second century of the town, the only demand that led to the exploration of the quarry rocks of this neighborhood. Indeed, we may say that the exploration of the exultant building and monumental stones so abundant here has been barely begun."

Not much thought had been given to the stone quarries until about 1800, when Jackson Field, Josiah Bemis, William Wood and William Packard first began to open quarries for the purpose of carrying on the stone business. "They may be considered the first persons who established the stone business in a legitimate manner in the town," says Dr. W. S. Pattee in his History of Old Braintree and Quincy, "but it was in a very small way, as there was no great demand for large building stones, and if there had been they would not have been able to supply the material for the want of proper apparatus and machinery for lifting and hoisting large blocks of granite. The stone quarried at this time was principally for underpinnings, doorsteps, etc."

In the Massachusetts records there is a letter dated 1721, describing a visit to Hangman's Island in "Braintry" bay, and to

Houghs Neck, near Squantum, and a return with a cargo of twenty tons of split slate, showing how extensively it was used even then. The use of stones for walls, steps and underpinning was constantly increasing.

The method of disposing of these stones and also preventing the exhaustion of these rough, coarse boulders for building purposes was the great topic and exciting question at the annual town meetings of Braintree. At length the inhabitants became somewhat alarmed that the drain created by the use of these boulders for building would not leave them enough to build a common stone wall, or construct a house cellar. To protect themselves from these invasions upon their property, they established the following rules: "1715—Voted, That no person shall dig or carry off any stone on the said commons, or undivided lands upon any account whatever, without license from the committee hereafter named, upon penalty of the forfeiture of ten shillings for every and each carload so dug and carried away; one-quarter part to be to the said committee in full satisfaction for the use of the town. The instructions to the committee were as follows:

"First—That the committee shall give no license to any and every person to dig or carry away any stone from said land, to make sale or merchandise thereof, without the town's direction.

"Secondly—That the committee may and shall license to any and every person in the town for such a quantity of stone as he or they shall stand in need of for their own proper use in the town.

"Thirdly—That the committee shall or may seize all stone that they shall find dug or carted on and off said common lands, the digger or carter whereof is not known, and the same disposed of to the best advantage of the town, by sale or otherwise, deducting one-quarter part thereof to themselves, in full satisfaction as above said."

For years after the passing of this ordinance the same general complaint was made at the annual town meetings that it was impossible for the town to enforce the rules they had adopted.

The inability to execute these regulations was probably caused to some extent by the more liberal views of its citizens who opposed it and who were not in harmony with those who advocated and sustained these rigid rules. They doubted the feasibility and justice of passing such onerous laws depriving them of the use of stone for common purposes, and at a meeting held in 1729-30 they were prompted to dissent from the action of the meeting. This dissatis-

faction evidently was the cause of the town being obliged to sell the North and South Commons in 1762 and 1765.

At the meeting of 1729-30 it was voted that no person be allowed from henceforth to take stone for his own use from off the common for building, fencing, or the like, without first giving notice to a committee by the town appointed of his so doing and rendering a true account of their quantity and how he disposed of them. They voted that there be five persons of a committee, any three of which shall be a quorum, and but three paid. "The following persons being then nominated to the committee were voted for singly, viz.: Thomas White, Benjamin Luddin, Benjamin Neal, Joseph Crosby, and Ebenezer Thayer. To this twenty-three voters entered their dissent."

In 1859, Chief Justice Shaw read the following valuable and interesting paper before the American Academy of Arts and Sciences: "The discussions which have recently taken place respecting the Hancock House have revived my recollection of the history of stone masonry and the use of granite as a building material in Boston and offers an occasion for stating what appears to me to have been an important discovery in the art of working granite within a comparatively brief period. It was said, I believe, of a man of antiquity, as one of his highest claims to the gratitude of his countrymen that he found the city of brick and left it of marble. We think that every one feeling just sentiments of pride for the beauty, permanency and grandeur of the city of his home, in the taste and utility of its public and private buildings must take a deep interest in knowing the value, cheapness and excellence of the building materials within its power for practical use. The vast number and magnificence of the granite buildings recently erected in the various parts of the city (Boston), increases the interest we naturally feel in knowing the steps which have led to this extension of the art by which granite is brought into use. My main object is to state a fact respecting it which I have never seen stated, which appears to me to be not generally known and which came to my knowledge under such circumstances as to command my belief.

"It is believed that although granite has been always abundant near Boston, it was not until some time in the early part of the last century that it was used as the building material of houses, but was used only for wharves, cellars and wells, where smooth and even walls were not required. It is believed that during the first century



MINOT'S LIGHTHOUSE, BOSTON HARBOR, MASS.



MONUMENT TO UNITED STATES REGULARS, GETTYSBURG, VA.  
*Erected by the Van Amringe Granite Company, Boston, Mass.*

of the existence of Boston, when smooth building stone was required to be used with brick building, or for basements, corners, window frames or the like, freestone was used, being the red sandstone of the Connecticut river.

"King's Chapel was built of coarse boulders dug out of the ground and then split and hammered. The boulders were split up for this building, it is said, by heating the stone (by building a fire upon it), and then splitting it by letting heavy iron balls fall upon it. Of course, granite obtained in this way was very expensive and the process could best be applied only to boulders having a free side. . . .

"When this work was finished it was the wonder of the country round. People coming from a distance made it an object to see and admire this great structure. The wonder was that stone enough could be found in the vicinity of Boston fit for the hammer to construct such an entire building. But it seemed to be universally concluded that enough more like it could not be found to build such another.

"At some time between the end of the first quarter and the middle of the eighteenth century, that is, now, a little more than one hundred years ago, the practice of stone hewing and hammering for the working of granite was first introduced into Massachusetts by German emigrants. It is understood that Brigadier-General Waldo brought a colony of German emigrants from their native country, a large number of whom settled at a place called Germantown, then in the town of Braintree, now Quincy. A large part of the colony proceeded under the care of General Waldo to Maine and settled in a new township then called Waldoborough, from which many settlers of German origin spread into other towns in Maine.

"The Germans who remained in Braintree introduced several branches of the mechanic arts, which had not before been in use in this country, among them stocking weaving, and the art of making glass and toys. . . .

"But what is more material to my present purpose is that this class of German artisans first introduced into this country the practice of preparing hewn or hammered stone, wrought to a plain surface, sufficiently straight and smooth to make a regular wall. The process as then practised by them and those who were instructed by them was understood to be extremely laborious, and, of course,

expensive, as the expense depended wholly on the amount of labor required for preparing it. Without describing the process precisely, which I do not understand sufficiently to do, I understand the first thing to be done was if the rock was in a quarry to blast out a portion of it by gunpowder. By this process, fragment should come out in all sorts of irregular forms, as by mere chance. The business of the workmen then was to take the pieces of more regular form and reduce them to smaller and more regular shapes, as wanted for building. This is done by cutting a groove on a straight line with a hammer made with a cutting edge like that of a common axe, then striking it with a very heavy beetle on each side of the groove alternately, until it would crack generally in the line of such groove. This would sometimes split in a line nearly straight, though it would often be irregular. In this way, by dividing and sub-dividing, the pieces were brought as nearly as practicable to the dimensions required, and then all the irregularities of surface must be removed by hard hewing with very heavy instruments.

"In this state of the trade, although stone might be gotten out and dressed and made suitable for building, yet few buildings were erected, probably on account of the great expense. Some of our older inhabitants may perhaps recollect the stone house at what is now the corner of Tremont and Somerset streets, long the hospitable mansion of Jeremiah Allen, Esq., a former sheriff of Suffolk, and celebrated for the number of good dinners given there. There was another granite house on School street next below King's Chapel, owned by John Lowell, Esq., who removed it and erected Barrister's Hall on the same site. But by far the most conspicuous dwelling was the Hancock House, still standing, built by Mr. Thomas Hancock. He was a native of Braintree, became a wealthy merchant, and probably chose to gratify his townsmen and himself by adopting as the material of his sumptuous dwelling one of these staples of his native town, without much regard to the cost. He was the uncle of John Hancock, and dying without children, gave the house to him. Governor Hancock had been erecting a house for himself at the corner of Court and Tremont streets, but having received from his uncle a gift of the Hancock House about the time his own was ready for occupation, it is believed he never lived in the one he built.

"It becomes a most interesting inquiry to learn to what this great change can be attributed. To call the attention of the public to this point is the sole purpose of this communication.

"I have always understood that the change was caused by the art of splitting granite with small wedges, which was unknown here until the time in question. This art, apparently not difficult or requiring any great skill, was yet of so great importance as to facilitate the working of granite and reduce the cost to such a degree as to render it comparatively cheap building material, regard being had to its strength, durability and beauty.

"The process, now so familiar, is a simple one, requiring no complicated apparatus, and no unusual skill or force when once known. But if, as it is supposed, it has produced these great changes, furnished the country with a most excellent building material at a cheap rate, and has filled our city with the permanent and sumptuous structures which are everywhere rising to constitute one of its chief ornaments, it seems an object of laudable curiosity to ascertain its origin and introduction, to learn who invented or first practised it, or whether it was in use elsewhere, and brought here, and by whom.

"This brings me to my main purpose, a statement given by the late Governor Robbins of Milton, as to the origin of the art of splitting stone. I give it with all the names and particulars, in order that the statements may be verified or refuted, by showing another and different origin of the introduction of this art, or by showing some other mode in which it was invented or brought here from elsewhere.

"Prior to 1798, Castle Island, in Boston Harbor, now Fort Independence, was the prison of the State, where convicts were sent to be punished by confinement and hard labor. About that time the United States, in anticipation of hostilities with the French, were desirous of having possession of Castle Island, in order to erect thereon a strong fortification for the defence of Boston, and for that purpose urged on the Commonwealth the necessity of having immediate possession of the island. The Commonwealth acceded and caused the prisoners to be removed, although the State Prison, at Charlestown, was not built or ready for their reception, nor was it so for some time after. This fixes the time when the State Prison was in the process of building. Governor Robbins of Milton was one of the first Commissioners, and in this capacity put himself into communication with all the workers and dealers in stone and found their prices very uniform, though, as he thought, very high.

"The narrative I am about to state he made to me twenty years after. I was then one of the agents for the public in erect-

ing a stone building for the county and probably that was the occasion of my interview with him. It was this:

"Desirous of getting the stone for the prison on the best terms, and believing the prices high, though general, he thought much and conversed much on the subject. In that state of mind, and deeply interested in the subject of stone, he had occasion to pass through Salem in a chaise. In passing along a street he noticed a building apparently new, the basement story of which was stone. He stopped to look at it carefully. In doing so he perceived along the margin of each stone the marks of a tool at distances of six or seven inches apart. This was something new. He had never seen it on hewn stone. He immediately inquired for the owner and saw him and asked if he knew how and by what process these stones were got out and wrought. He said he did not, but referred him to the contractor who did most of that species of work in Salem, by the name of Galusha. As I took the name by the sound only, the orthography may be different, Galowcia or Galooshy. He then proceeded to find Mr. Galusha, and to ask him whether he got out these stones and by what process. He said he did not get them out himself; that they were obtained in Danvers, two or three miles distant, and were furnished by a man named Tarbox. Upon asking for directions to find Mr. Tarbox, Governor Robbins was told that he was a very poor man, being in an obscure situation in Danvers, near the place where the stone was quarried. Governor Robbins determined to pursue the inquiry, immediately proceeded to Danvers, and after considerable inquiry, he found Mr. Tarbox in a small house with a family, and with every appearance of poverty about him. After some little preliminary conversation, he asked Mr. Tarbox if he got out the stone in question, and if so, his method. He told him he had, and immediately proceeded to explain the process, and showed him his tools, his mode of drilling the holes and inserting and driving the small wedges as above described.

"Governor Robbins was at once struck with the idea that it was new and peculiar, and might be a very important invention. Governor Robbins did not say that he asked whether it was an invention of his own, or whether he had learned it of anybody else. But as it was new to himself, I think he was impressed with the belief that it was the invention of Tarbox. It did not seem, however, that he had any exclusive or peculiar interest in the use of his art. Governor Robbins then asked him if he would consent to go up to Quincy

and work two or three months, and split stone in his mode, so that other workmen might practise it. He said it was impossible for him to leave home, that his family were dependent on him for their daily bread, and that he had no clothes suitable to go from home. Governor Robbins obviated all his objections by making provisions for the family during his absence, also engaged to give him two or three times the monthly wages usually paid the best stone cutters, and the man consented. Having made the necessary arrangements he took him to a clothing store in Salem, obtained him a suitable outfit, then took him into his chaise and brought him to Quincy. Governor Robbins added that he introduced Mr. Tarbox to several of the principal stone dealers, and that it was not three months before every stone cutter in Quincy could split stone with small wedges as well as Mr. Tarbox. Also that this improvement in the working of granite had in a very short time the effect to reduce the price to five-eighths of its former cost; that is, that the cost of the dimension stone wanted for the prison, which had before been \$4.00, was afterwards reduced to \$2.50, and other granite work in similar proportion.

"I have been thus particular in naming persons and stating circumstances, in the hope that there is some person still alive, either at Salem or Quincy, who can throw light on the subject. It would be very extraordinary if an art of so much importance should be traced to a source so obscure as poor Mr. Tarbox, who seems to have been hardly conscious that he was doing anything extraordinary. It may be that this whole narrative rests on some mistake, and that a different origin for this art of working granite may be shown. If so, it is very desirable that it should be known to the public."

In the face of these facts we must doubt the correctness of the following statement by Dr. Pattee in his "History of Quincy": "One Sunday in 1803, the first experiment in splitting stone with wedges was made by Josiah Bemis, George Stearns and Michael Weld. It proved successful, and so elated were these gentlemen on this memorial Sunday that they adjourned to Newcomb's Hotel, where they partook of a sumptuous repast. The wedges used in this experiment were flat, differing from those in use at the present time. The stone cutters found it so troublesome to go to the center of the town to have their tools sharpened, that in 1804 they had the first blacksmith shop in the Commons near the quarry of the late Henry Wood."

Surely a man of the intelligence possessed by Governor Rollins

and holding the position of commissioner for building the State Prison would know as to whether the wedge-splitting process was in use before he introduced Mr. Tarbox. Then there is the important fact that immediately after Tarbox had taught the Quincy stone cutters his method they all used it with the result that the cost of dressed granite blocks was greatly reduced. It is quite clear to my mind that Mr. Bemis and his associates had copied the process from Tarbox and had on the "memorial Sunday" successfully split their first block of granite.

In 1737, the old Hancock House, taken down during 1863, was built of Braintree boulders, squared and hammered with old free-stone trimmings from Middletown, Connecticut, and it was slated (probably at some later date) with slate from Lancaster, Massachusetts. This building then was the first in New England, if not in the country, to be built of granite, and although a beautiful and dignified residence, it was not so imposing as King's Chapel, now standing on the corner of Tremont and Schools streets, which at the time it was built (1749-54) was the greatest stone structure ever attempted in Boston, if not in the United States.

At a meeting of the committee for the rebuilding of King's Chapel (Peter Harrison of Rhode Island, architect), at the house of Mr. Barlow Trecothick, June 20, 1749, it was found that the committee being every day encouraged to inspect their plan, consulted about supplying themselves with stone, lime, etc., at the cheapest rate, and as the summer was now considerably advanced, agreed that the building should be begun with all convenient speed.

"Voted, unanimously, that Mr. B. Trecothick make an agreement with Mr. George Tilley tomorrow, to cart all the stones, sand, and other materials that shall be landed at his wharf to the spot where they are to be used, at the rate of sixteen shillings, old tenor [50 cents] per carload for such as are landed and carted from this time to the 20th of March next."

"Voted, That the committee meet Mr. Endicott & Co. at the schoolhouse tomorrow morning, and dispose of the old stones, bricks and iron work about it to them on the best terms they can, to be removed at the expense of the purchasers. Voted, also, That Dr. Gardiner be empowered to agree with the Roxbury men for as many cartloads of stone as are necessary for the foundation, on the best terms he can, not exceeding sixteen shillings, old tenor, per load."

It was also "Voted, That Dr. Gardiner, if he has opportunity or otherwise, some other of the committee, do agree with Mr. Hayward of Braintree for as many of the South Common stones as will be wanted this fall, at £40, old tenor, for a boatload of 24 tons of said stone delivered at such convenient wharf, at Boston, as the committee shall appoint.

"Voted, That Mr. Hunt shall get as many North Common stones as will be wanted this fall at £52, old tenor, for 22 tons, to be delivered at such convenient wharf in Boston as the committee shall appoint."

The agreement with the masons to build this famous old church is as follows:

"Boston, July 26, 1749.

"It is this day agreed between us, the subscribers and the committee for rebuilding King's Chapel, to lay the foundation of the said chapel, to the height of the first floor, in stone and mortar, to the thickness of four feet; all above ground to be square pointed without pinners, the faces hammered square, and to be performed in every respect in a workmanlike manner, for which we are to receive of the said committee at the rate of five pounds, old tenor, for each perch of one foot high, sixteen and one-half feet long, and four feet thick, as the said work goes on, and in case we make it appear to the said committee that we are sufferers by this agreement, we are to receive such further allowance as they shall think just. Witness our hands.

DANIEL BELL,  
GEORGE RAY."

The foundation stone was laid August 11, 1749, when a large congregation, including Governor Shirley, was present. The governor gave the masons £20 (about \$10.00) to drink his health then with his associates went into the Old South Meeting House for prayer.

The first King's Chapel was erected of wood in 1688, enlarged in 1710, and being found in 1741 in a state of considerable decay, was rebuilt in 1749 at a cost of over £25,000, old tenor. (£100 sterling or about \$500, was equal to £1000, old tenor.)

The workmen proceeded with their labor but slowly. Granite was not then the manageable material that it is now. In the meantime, the congregation continued in the old chapel, decayed and

partially unroofed by a severe storm as it was, while the walls of the new structure were gradually rising around it.

An application was made to the "celebrated" Ralph Allen, Esq., of Prior Park, near Bath, England, for freestone from his quarries for the interior and ornamental part of the work. The stone was promised, but as it was found that the expense of working it would be greatly beyond the means of the church, the idea of using it was abandoned and wood was employed instead for the pillars and decorations.

In 1774, the old powder house that stood near what is now Pinckney street, was built of Braintree granite with walls seven feet thick and having a bomb-proof arch. It was surrounded by palisades and was estimated to contain, when full, a thousand barrels of powder. In 1793, a stone lighthouse was built on Lighthouse (or Beacon) Island.

The first full cornice known to have been worked of granite in this country was for the United States Bank, near the corner of State, and what is now Devonshire street. This cornice was executed of Concord granite at the State Prison. Gradually granite came into use, and what was at that time considered a strongly-marked improvement in taste and in construction immediately followed the building of the Obelisk at Bunker Hill.

About this time marble began to be used for building, corresponding to the opening of the Berkshire, Massachusetts, marble quarries (1790). The State House at Boston, built 1795-'98, is described in old books as having keystones, imposts, etc., of white marble. Part of this came from Boynton's quarry in West Stockbridge, Berkshire County. The "new almshouse," erected in 1800, had marble trimmings, and the Exchange Coffee House, built in 1805-'08, had six large marble columns or pilasters upon a rustic basement, supporting an architrave, and a cornice of the same stone. The base of the building was of hammered granite and the basement of white marble. The old Custom House, built in 1810, also had marble trimmings.

Granite then began to be used extensively in Boston and was of two varieties: white granite (the so-called Chelmsford), from Tyngsborough and Westford, near Lowell, Massachusetts; and, perhaps, some from Pelham, New Hampshire, and other places, quarried generally if not entirely for many years from loose boulders, and the dark Quincy granite, almost mostly from boulders, but a

little from ledges. Thus in 1810, the old Court House (old City Hall on site of present City Hall) was built of white Chelmsford granite. In 1814 the New South Church (at the intersection of Summer and Bedford streets, known as Church Green), was built of the best Chelmsford granite. At about the same time what was known as the Congregational House (corner of Beacon and Somerset streets), was built; the old Parkman House in Bowdoin square, University Hall in Cambridge, and from 1818 to 1821, the main part of the Massachusetts General Hospital, with its several large granite columns, hammered at the State Prison—also was of Chelmsford stone—probably from boulders.

The completion of the Middlesex canal from Boston to Chelmsford (30 miles), in 1803, itself a great work, with sixteen locks of hewn granite, opened the way for the easy transportation of granite from the vicinity of Chelmsford, so that it could be delivered in the very streets of the city, and great quantities were landed at the State Prison, in Charlestown, and cut by the convicts. All, or nearly all, of this stone came from the surface boulders, as is stated, as late as 1820, and were split as at Quincy. In 1818, a church was built of this stone in Savannah, Georgia, for which purpose \$25,000 worth was sold.

In 1818-'19 there was built of this material the first stone block in Boston, still standing in Brattle street, and forming originally a block of fourteen buildings, part of which now forms the old part of the Quincy House. Stores erected on Cornhill in 1817 were the first erected in the city on granite pillars, and in 1820 these were first substituted in brick buildings already standing. Some yellow sandstone from England was used in buildings on Cornhill in 1817.

The mill dam connecting Brookline with Roxbury, and built from 1818 to 1821, was considered one of the grandest constructions of the kind in the world. The sides of the dam were built of solid stone for 8000 feet in length, from three to eight feet thick and twelve to seventeen feet high, while the width between the walls varied from fifty to one hundred feet. The stone used was Roxbury pudding stone and stone from Weymouth.

In the 20's began in Boston what may be termed a Grecian age, when a sort of Greek revival was the object of the few architects working in the town. Not only churches, public buildings and stores, but even dwelling houses were fitted out with a portico of columns in the severest cast of doric.

The uses to which the building was devoted were not considered, it was the style, and never did an architectural fad so strongly possess the people as this, and perhaps no absurdity of fashion in architecture was ever more preposterous.

A few buildings erected in that period still survive and excite the curiosity of even the most casual observer. The old Merchants' Exchange, the Tremont House, the Revere House, the United States Court House on Tremont street and Temple place, the Old Court House on Court street, and the Granite Bank on State street, are still fresh in the memory, but St. Paul's Church, Custom House, Faneuil Hall Market, Charlestown Navy Yard buildings, "Presidents'" or Stone Church, Quincy, Massachusetts General Hospital, Fitchburg Railroad Depot, Charles Street Jail, and many others are daily reminders of this "stone age."

Often, as in the case of the Old Court House, the portico was the only attempt at architecture in the whole building. Often, as in the case of many suburban houses, the great wooden columns three or four feet in diameter were backed by a front wall pierced by three stories of parlor and chamber windows.

Where the Merchants' Bank now stands at the corner of State and Devonshire streets, was formerly the pretentious structure of the United States Bank. It was erected in 1824, Solomon Willard being the architect and Gridley Bryant the master mason. The two fluted columns in the Merchants' Bank of today are relics of the ancient structure. These two columns were originally twenty-four feet high, including the cap, and four feet in diameter at the base, and were cut from a large boulder of granite in Westford, Massachusetts. When set in their present place they were reduced in size. The Massachusetts General Hospital, at the west end of McLean street, was built in 1821. The main building is of Chelmsford granite hammered out and fitted for use by the convicts of the State Prison. In 1846 it was enlarged by the addition of two extension wings. Other additions and improvements have from time to time been made.

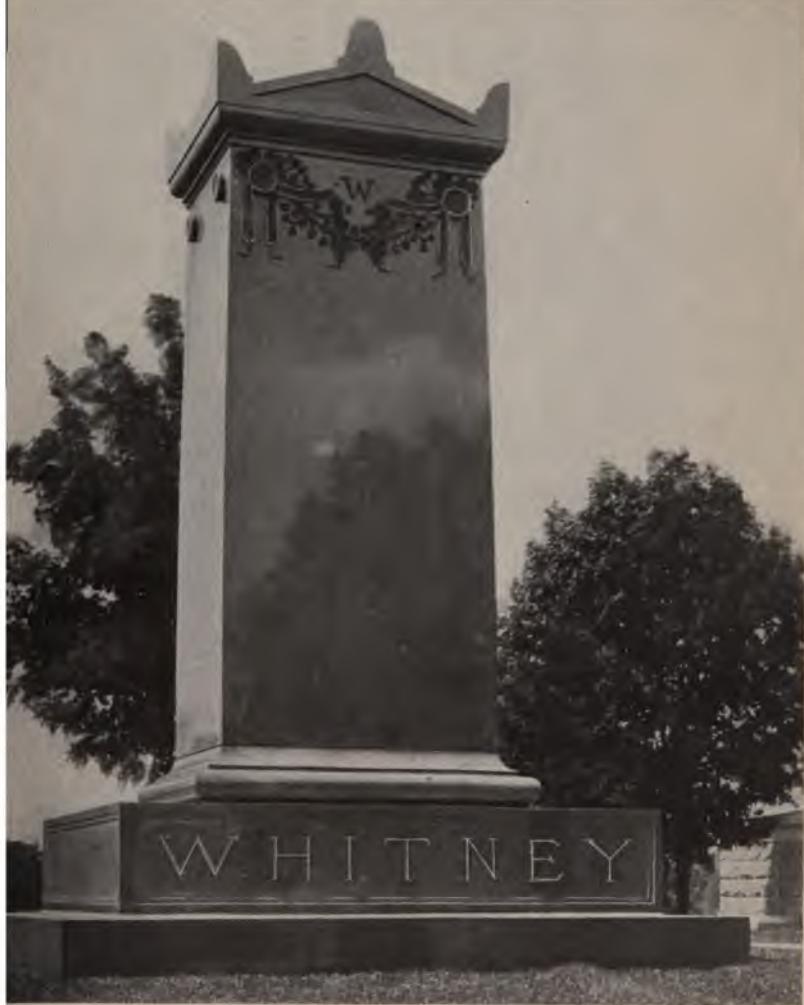
Under the great overhanging gable of the immense granite building used by the United States appraisers as a storehouse, and looking down upon the Custom House, there is a huge stone globe. It was cut about 1840 from one piece of Quincy granite, and during the fire which threatened to destroy the building several years ago, the firemen were in a constant state of alarm that the intense heat



L. S. ANDERSON,  
*Treasurer and General Manager, Granite Railway  
Company, Quincy, Mass.*



DOWN 150 FEET IN THE EXTRA DARK QUARRY OF THE GRANITE RAILWAY  
COMPANY, QUINCY, MASS.



ISHED DARK QUINCY GRANITE, CUT BY THE GRANITE RAILWAY  
COMPANY, QUINCY, MASS.



COAL TRAIN ON CHURCH CREEK RAILROAD. OPERATED BY THE CHURCH CREEK RAILROAD

might crack the keystone supporting it and let the huge solid mass down upon them.

The name of Charles Bulfinch is one of the most honorable in the history of American architecture, and few, if any, in his profession has enjoyed the reputation in Boston and New England which he enjoyed in the beginning of the past century, and there have been few architects who have stood so prominently before the country at large. He was the son of Dr. Thomas Bulfinch and was born in Boston in 1763. He was sent abroad to study and returned in 1786, and it is only a few years after this date that he is found in active practice as an architect.

Before his day there were but few public buildings that would attract the notice of a stranger. Architectural beauty was but little considered, mere adaptation to the purposes of the structure being all that the builder attempted. The Beacon Hill monument, the Franklin street crescent, and the new State House introduced a new era which Rogers, Willard, Parris, Bryant and Billings have perpetuated. The impress of Mr. Bulfinch's genius is seen not only in his native city, but in the capital of the nation, which was planned by him after the destruction of the original by the British General, Ross. Besides other works he was architect of the State Prison, the old City Hall, the old Cathedral, Federal Street Church and Theatre, enlargement of Faneuil Hall, Massachusetts General Hospital, University Hall at Cambridge, State House, Augusta, Maine, besides numerous churches, theatres and private residences.

On April 25, 1825, the corner stone of the building generally called Quincy Market, but officially known as Faneuil Hall Market, was laid, the architect being Captain Alexander Parris. This corner stone was a large block of Chelmsford granite. The following is a description of the building: Market house, all of granite; length, 535 feet 6 inches; width, 50 feet, having a central building 74 feet 6 inches by 55 feet, with a portico on each end; the porticos consist of four granite columns,  $3\frac{1}{2}$  feet in diameter at the base, and 2 feet 10 inches at the top; each shaft is 20 feet 9 inches long, with a Doric capital. Some authorities say these massive columns were taken from a quarry in the town of Chelmsford and were brought to Boston through the Middlesex canal to its terminal at "Charlestown mill pond," thence across the river to the dam where now is Causeway street, and through its gates into the "Boston mill pond." From this they were taken by the old "mill creek," now covered by

Blackstone street, to the Town Dock, near Faneuil Hall. The whole edifice is supported by a base of Quincy blue granite, 2 feet 10 inches in height, and covers a space of 27,000 square feet. The cost above the land was \$150,000—probably very much less than a building of the same kind would cost today. To carry this enterprise to completion the city erected the building, laid out six new streets, enlarged a seventh, including 167,000 square feet of land, besides obtaining flats, docks and wharf rights to the extent of 142,000 square feet, without any debt or burden on Boston's pecuniary resources, but with large permanent additions to its real and productive property.

Captain Alexander Parris, who was equally able as an engineer, was a native of Pembroke, Massachusetts, where while working as a carpenter's apprentice he studied architecture. He went to Portland, Maine, and made several important buildings, and then worked a short time in Richmond, Virginia, but did not come to Boston until the close of the war with Great Britain, in 1815. He was a resident of Boston until his death, June 16, 1852.

Besides the Quincy Market, Captain Parris built the Marine Hospital at Chelsea, the Arsenal Building at Watertown, and was for years constructing engineer for the Charlestown Navy Yard, in which capacity he was charged with many positions outside that office, such as the construction of sea walls on the islands of Boston Harbor, and several lighthouses, beacons and breakwaters on the New England coast. In conjunction with Solomon Willard, architect of Bunker Hill monument, and Alpheus Carey, mason, he built Saint Paul's Church on Tremont street, which is regarded as their best work. The corner stone of this church was laid September 4, 1819, the parish being formed principally out of Trinity.

"This Grecian Temple," said Bishop Brooks, "seemed to the men who built it to be a triumph of architectural beauty and of fitness for the church service." It is built of fine gray granite, and is an imitation, so far as respects the architecture, of a Grecian model of the Ionic order. It presents to the street a simple Ionic hexastyle portico with six Ionic columns of freestone from Acquia creek and a pediment which it was intended to finish by a sculptured bas-relief representing Paul preaching at Athens. The requisite funds, however, were wanting, and the rough blocks remain to this day to remind us of Willard's masterpiece.

The columns are 3 feet 5 inches in diameter and 32 feet high, laid in courses. The capitals were carved by Willard. The body of

the church is about 112 feet long by 72 feet deep, and 40 feet high from the platform to the top of the cornice. The building cost about \$83,000.

The Boston Custom House is a massive granite structure built in the form of a Greek cross, the opposite ends and sides being alike. It was begun in 1837, and finished in 1847, at a cost of more than \$1,000,000. The roof of the dome is also of granite. The exterior of the building is purely Grecian Doric—not a copy—but adapted to the exigencies and peculiarities of the structure, and consists of six columns on each side on a high flight of steps, and an order of engaged columns around the walls, twenty in number, on a high stylobate or basement, the order of engaged columns terminating with four *antæ* at their intersection with their porticos. The columns are 5 feet 4 inches in diameter and 32 feet high, the shafts being in one piece, each weighing about 42 tons.

The production of these large granite columns was the work of a syndicate of the leading granite workers of Quincy. Many of the columns were transported from the Quincy quarries under the superintendence of Henry West, with a team of 55 yoke of oxen and 12 horses. On the interior of the building is a large rotunda, 63x59 feet in dimensions, and 62 feet high, in the Grecian Corinthian style. The ceiling is supported by 12 marble columns three feet in diameter and 29 feet high.

Ammi Burnham Young, architect of the Boston Custom House, was born at Lebanon, N. H., in 1798 or 1799. His father was Samuel Young, a somewhat noted builder of churches, court houses and academy buildings in that part of the country. One of his earliest works, and in many respects his best, built in 1835, was the State House at Montpelier, Vermont. In 1838 his design for a new Custom House in Boston was accepted and the building completed in 1848, under his personal supervision. In 1850 he was a leading competitor for the enlargement of the capitol at Washington, but was finally defeated by Mr. Walter of Philadelphia. As a sort of compensation, President Fillmore appointed him supervising architect of the Treasury Department, the first to fill that office, and he moved from Boston to Washington. He remained in office until he was removed by President Lincoln, about 1863. During his incumbency he drew the plans for a large number of public buildings, mostly in the West and South (post-offices, custom houses, court houses, etc.), and superintended their erection. In Boston he built

and lived in the house at the southeast corner of Bowdoin street and Ashburton place. He died at Washington in 1866 or 1867.

Gridley James Fox Bryant, son of the inventor of the first railway, was born in Boston in 1816, a year that was the coldest on record, in which there was frost every month of the year. He studied in the office of his father, and of Alexander Parris. He opened an architect's office at the corner of Court and Washington streets. His first achievement was the design for the Broadway Savings Bank, South Boston, which was built in the early 30's. A few years later he built the first fireproof building in Boston, the building that was for years occupied by the Registry of Deeds. He built the Charlestown State Prison and the Charles Street Jail, besides many other like institutions throughout New England, and later remodelled the State Capitol at Concord, New Hampshire. In 1853 he added a fireproof extension to the rear of the Massachusetts State House. When he had just passed his thirty-fifth birthday, Franklin street, Boston, was opened. He started to build up the street with granite buildings to be occupied for business purposes, he having already erected the Martin, Goddard, Milk and Old South Blocks on Milk street. His handiwork was seen in custom houses, government buildings, churches, schoolhouses and private residences all over the country. Some idea of his popularity as an architect may be had from the fact that he had 152 buildings destroyed in the Boston fire of 1872, of which he was commissioned to rebuild 110. He died in 1883.

Cook, Greenleaf & Metcalf built the front of the old Tremont House in Boston in 1827-28. Their apprentice, Charles Cushing, formed a partnership with Nathaniel Adams, and they did considerable work on the Bunker Hill monument. Among the buildings which they erected were the Lewis Wharf stores, Constitution Wharf stores, twenty stores on Commercial street, fourteen on Fulton street, fourteen on Long Wharf, Dr. Beecher's Church and Beebe's dry goods store, all or most of them being of granite.

The Pagoda Building which stands on the northern corner of State and Washington streets, is in some respects one of the most artistic and picturesque bits of architecture in Boston, and was the forerunner of the skyscrapers of today. In fact, in its day it was regarded as a skyscraper, and back in the 40's was the highest building on Washington street. In these days the building was regarded as a curiosity, and owing to its general outlines and double cornice

which suggested an Oriental pagoda, it was popularly known as the "pagoda building." It was erected in 1843 from designs by Snell & Gryerson, also architects of the old Music Hall. In this pagoda building is seen about the very first attempt in Boston to beautify the exterior of a building. It is of Quincy granite and is seven stories in height. The six upper stories were used for residential purposes, and the street floor for business, but the entire building now is used for business.

The old Fitchburg Railroad Depot in Boston was begun in 1847, but was not completed for several years. When finished it was looked upon as the most remarkable building, not only in Boston, but in the whole country. Excursion parties used to visit Boston just to see the structure that was the talk of the land. The solid blocks of granite that comprise its massive walls were quarried about ten miles above Fitchburg. The walls are two and a half feet in thickness. Its dimensions are 75x310 feet, and it cost about \$500,000. Up to as late as 1875 the towers in the front of the building were open, and winding stairs wound around their interior to the large hall that for a long time extended the entire length of the second story. What was the original purpose of this hall does not seem to be definitely known. It was in this hall that Jenny Lind gave a concert during her first visit to the United States, it being the largest in the city. During the Civil War, or rather at the beginning of hostilities, this hall was used as a drilling place for recruits but was discontinued as the double quick drill shook the floor so that the building inspectors stopped it. The floor was supported from the roof.

These buildings may be mentioned as opening the great development in the construction of Quincy granite structures and as showing how that granite supplanted the Chelmsford. This is only true of Boston. Other cities like Concord, New Hampshire, and Montpelier, Vermont, were using granite in considerable quantities for building and monumental purposes early in the beginning of the nineteenth century, but their history will be found under the chapters devoted to their respective localities.

In 1842 there was much use of the Somerville diabase for basements of brick buildings, and of red sandstone for trimmings. About 1845 the red sandstone came in favor for fronts, and several churches, the Boston Athenaeum, etc., were soon erected of this stone. Rockport granite began to be used from the quarries about

1830, and was at first put into cellars for brick buildings and then for posts for North and South Market streets. The first building of hammered Rockport stone was that of Terice, How & Co., about 1846, and the Beacon Hill reservoir, a little later, was a very extensive undertaking.

The Parker House, erected in 1854, was the first marble building in the city. Concord granite was first used in columns in the Boston & Albany Depot. The Merchants' Bank Building was perhaps the first front (1856) of Concord granite. The Washington Building, which stood at the head of Franklin street, is said to have been the first building of Nova Scotia freestone (1858). Within sixty years various other building stones have been introduced: the Roxbury pudding stone for churches, the different marbles and sandstones and the red granites.

The old City Hotel stage stables in Boston had round granite pillars which supported the high arches and through which so many famous four or six-in-hand had dashed out, was levelled in 1874. They seemed to stand there for an eternal monument of the old stages and their departed days, but they were thrust out of the way to make room for the giant march of material progress.

The style of the public buildings of Boston just after the close of the Civil War followed the lead of the French architects of the second Empire, whose works were illustrated with great minuteness in numberless published serials and monographs. The City Hall, Post Office, and old Horticultural Hall are imitations as close as the slenderer resources would allow, of that ambitious and grandiose style, of orders superimposed and heavily-loaded mansards, which reached its climax in the pavilions of the new Louvre.

To such a style, with columns and entablatures, granite, so much an object of local pride, was supposed to lend itself with peculiar fitness, on account of the facility with which large stones could be quarried, and the safety with which, by reason of its great strength, large openings could be spanned. "But," says Charles A. Cummings, in the Memorial History of Boston, "our native gray granite, admirable for works of engineering or of architecture in which the chief expression desired is that of massiveness and strength, is one of the least admirable for any purpose of grace or luxury. Its color forbids any agreeable play of light and shade, and its texture scarcely admits of close-cut ornament except at great expense, and when all is done the ornament is without effect. The most striking example of the

right use of granite is the Beacon Hill Reservoir, perhaps the noblest piece of architecture in the city, absolutely adapted to its purpose, and absolutely free from excess or effort or affectation—its cyclopean masonry unvexed by details and unbroken save by the single order of grand arches, of which the five on Derne street are almost Roman in their grand depth of shadow. The reservoir has stood for thirty-five years, and having been proved to be a useless portion of the system of water works is now being taken down. . . . But in buildings erected for the ordinary uses of life, such repose as this, is, of course, unattainable. The reasonableness of leaving granite without ornament, and with its wall face untooled was, however, at length generally recognized, and in many blocks of warehouses, notably those on Commercial street and Long Wharf, in the jail for Suffolk County, on Charles street, and various other less conspicuous instances, this stone was used with right judgment and excellent effect.

"During the period when brick was considered too common for use in fine buildings, the choice of materials at the command of the architects was practically limited to the granite at Quincy, Rockport, Concord, and other New England quarries, and the brown freestones of the Connecticut Valley or New Jersey. . . . But about the time when building was commenced in the new lands of the Back Bay, other stones made their appearance, one after another, until the variety now within the architect's reach is quite bewildering. The white and the gray marble of Vermont and New York were followed by the light sandstones of New Brunswick and Ohio, and the red granite of the eastern coast."

The building of the Back Bay residences has been very extensively done with sandstone fronts, but of late years the larger public and semi-public buildings are built of granite, marble and other beautiful stones. The great fire in Boston in 1872 wiped out hundreds of stone buildings and blocks which had been erected during forty years in the business portion of the city. The buildings were very largely of granite from Quincy, Rockport, Concord, Hallowell and elsewhere, and in their place have sprung up buildings of lighter colored stone, Concord and Rockport granites, and a great proportion of buildings of the yellow sandstones of Ohio and the Provinces together with many of marble.

The National Census for 1880 gave the number of buildings in Boston made of granite as forty-five, and of those with granite

fronts or sides as two hundred and sixty-seven, the larger number being constructed of Quincy granite. Of those buildings the principal ones have already been mentioned. The following list embraces those buildings in the city constructed of granite from other quarries:

Cape Ann granite—The United States Post Office (1869-'82) is one of the finest granite buildings in the city. The stone was furnished from Gloucester, the basement of darker stone from the Blood quarry and the superstructure from the "Old Pit" quarry. The superstructure of that part of the building first erected was taken essentially from one sheet in the quarry; the stone is syenite. The pavement on the floor is from Swanton, Vermont. Lawrence Building on Tremont street, Bigelow, Kennard & Co., Washington street, Wesleyan Hall, Commonwealth Building, St. Vincent de Paul Church, South Boston; Church of Our Most Holy Redeemer, East Boston; rope walk at Navy Yard, 1360 feet long; South Boston Savings Bank, and many stores.

Concord granite—Herald Building, Transcript Building, Wentworth Building, Emigrant Savings Bank, City Hall, Massachusetts Historical Society, Suffolk Savings Bank, Horticultural Hall, Masonic Temple, Advertiser Building, Merchants' National Bank, National City Bank, Lawrence Building, Rialto Building, New England Mutual Life Insurance Company's Building (standing), Brooks estate, Union Institute for Savings, Bowditch Block, Odd Fellows' Memorial Hall (in part). Cruffs Block is from Fitzwilliam.

Chelmsford granite (Westford, etc.)—Besides buildings already mentioned, Church of the Immaculate Conception; Somerset Club, Quincy House (old part), two blocks of stores, North and South Market streets.

Hallowell granite—Equitable Insurance Company's Building, Odd Fellows' Memorial Hall (part), Quincy Market (part), Mutual Life of Maine, National Bank of the Republic, large block in Winthrop square (part).

Other granites—Rollstone Hill, Fitchburg; Fitchburg Depot; Jonesboro, Maine (Bodwell Granite Company) old granite; Wellington Brothers' Building, Nevin Brothers' Building, Moose Block and Preston Building. Saint George, New Brunswick, red granite; Bedford Building. Vinal Haven, Maine, reddish granite (Bodwell Granite Company): Building corner Kingston and Bedford streets,



ANDREW MILNE,  
*Firm of Milne & Chalmers, Inc., Quincy, Mass.*



PLANT OF BIRNIE & DIACK, QUINCY, MASS.

Medford and Somerville black granite (diabase) : Front of building corner of Harrison avenue and Way streets. Porphyritic granite from Frankfort, Maine; Gerrish Block (1849). Concord granites are the most used for trimmings and supports; also granite from Spruce Head and Hallowell, Maine. Red granite from Westerly, Rhode Island, has been used in some churches, although the Catholic churches seem to prefer Rockport granite. For foundations the granite from Quincy and Cape Ann, together with Cambridge slate and Roxbury pudding stone are used. The Somerville diabase was extensively used sixty years ago, and about seventy-five years ago the rails of the Lowell railroad from Boston to Medford were laid on a foundation of this stone from the quarries at Dane ledge, Somerville. For underpinning, Quincy, Rockport and Concord granites were generally used; red and yellow sandstones also very extensively in dwellings. Hallowell, Spruce Head, Vinal Haven, Deer Island and other Maine granites have also been used, while in the very old houses are found the Chelmsford granite, looking very rough, as the bush hammer had not been invented. Somerville diabase was used in certain localities, as was Connecticut sandstone, marble, and Hudson river blue stone. The granite basement of Art Museum Building (demolished 1911) was from Mr. Corrigan's quarry at Randolph, Mass. Posts and walls were made generally from the varieties of granite.

In the Chestnut Hill Reservoir the lining is trap and pudding stone with a cap of Douglass mica-schist. The East Boston and West Boston Reservoirs were lined with Quincy granite. The Chestnut Hill Reservoir has a pudding stone wash wall with a cap of granite from Graniterville, Massachusetts. The Mystic Reservoir has a granite cap. The Sudbury river conduit crosses Charles river over a bridge 475 feet long of granite from the Cape Ann Granite Company; and the Waban valley bridge of the same, 536 feet long, is from Spruce Head and Deer Isle, Maine. The abutments of the older Boston bridges are of granite from Quincy, Cape Ann and various other places; the West Chester Park bridge, for instance, is of Milford, Cape Ann, Deer Isle and Mount Desert granite. Braggyville granite has been used extensively by the Boston & Albany Railroad. But railroad construction work, which has included about all kinds of stone, has given place to concrete. For the sea wall surrounding the city, Rockport and Quincy granite, Somerville diabase, pudding stone, etc., have been used. In the sea

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alls built extensively in the harbor on Galloup's Island, Point Ellerton, Long Island, etc., granite has been used, also a great deal from Biddeford and Bamebrush, Maine. Forts Winthrop, Warren and Independence in the harbor are of granites from Quincy, Rockport and other quarries.

## CHAPTER II.

IMPETUS GIVEN TO THE INDUSTRY BY THE CONSTRUCTION OF  
BUNKER HILL MONUMENT.

THE father of the granite business in the United States was Solomon Willard, a native of Petersham, Massachusetts, where he was born, June 26, 1783. He worked on his father's farm during the summer, and in dull weather and winter in his father's carpenter's shop. In October, 1804, he went to Boston to seek employment, and commenced to learn the carpenter's trade. The first work he did was to fit with the broad axe a set of piles for the building of a wharf, his employers being Pond & Gale. He received fifty cents per day, including board. But before the end of the first year Mr. Willard had worked for several parties, and had saved money. He worked at this trade several years, and in the meantime he studied architecture, attended an evening drawing school and practised wood carving. His first work as a carver was when he did six capitals for a doorway for Mr. A. Dexter, in 1809. The same year he carved a set of Ionic capitals for the Brighton Meeting House, and two others for private residences. He also carved all the capitals, Ionic and Corinthian, for the steeple of Park Street Church, for which he received nearly four hundred dollars. In December he hired a room on Somerset place and employed two workmen to assist him. In 1810 he carved the colossal eagle which was placed upon the apex of the pediment of the old Custom House, where it remains still. He continued his business as carver, and in 1813 added to his architectural work that of ship carving, and in 1818 made a model of the capital at Washington for Charles Bulfinch, the architect, besides several others of a like nature. His models of the Pantheon and Parthenon made for Edward Everett, and used by that notable in a course of lectures, are in existence still in the basement room of the Boston Athenaeum. After his return from a few months' visit to the South he made himself familiar with the different kinds of stone and their component parts, and devoted much time and labor to a practical investigation of the science, so

that he had soon added to his other pursuits that of carving in stone, or sculpture in its limited and popular sense. His first work of this kind was modelling and cutting five panels in marble for David Sears, still seen in front of his fine granite mansion house on Beacon street, in Boston, and for which he was paid five hundred dollars.

In 1820, Mr. Willard was engaged on the stone work of Saint Paul's Church, Boston. During the following year, he, besides finishing plans, designs and models, including plans of improvement for the Second Church and Brattle Square Church (1823-'24), a plan and model for the United States Branch Bank, plans and outlines for many private houses and blocks, received pupils at his studio near Saint Paul's Church and gave lessons in architecture and drawing. To Mr. Willard belongs the credit of originating in this country the first steps towards heating buildings with hot air, he having invented but never patented the hot air furnace. They were manufactured by Daniel Safford on Devonshire street, between Water and Milk streets, and were intended for consuming wood, then the common fuel of the people, and hundreds were installed in churches and other large buildings, including the capitol at Washington.

The great work of Mr. Willard's life, for which he was prepared by circumstances, into which he threw his energy and skill, and which, for the time, was a part of himself, was the Bunker Hill Monument. The first suggestion of the monument is credited to William Tudor, who desired to see on the battleground "the noblest column in the world." About three acres of the field was bought by Dr. John C. Warren, who held it until wanted by the Monument Association. A party who felt deeply interested in the erection of a monument on this site assembled at breakfast at Colonel T. H. Perkins' home, among them Honorable Daniel Webster, Professor George Ticknor, Doctor John C. Warren, Honorable William Sullivan, Honorable George Blake and William Tudor, Esquire. They then visited the battleground and consulted in reference to building a monument.

May 10, 1823, the first call for a public meeting was sent out, and the gentlemen who attended this meeting formed an association to procure an act of incorporation authorizing them as trustees to collect and hold subscriptions for the purpose of erecting an enduring monument. Each one subscribed five dollars and on June 7, 1823, the Bunker Hill Monument Association was established. Then began the work of raising money. The directors, in the spring

of 1825, had secured the title to the land and purchased the slope of Breed's Hill—about fifteen acres—and made other necessary preparations, but had not matured the plan of the proposed monument. The first committee on the design consisted of Daniel Webster, Loammi Baldwin, George Ticknor, Gilbert Stewart and Washington Allston. A premium of \$100 was offered for the best design. About fifty plans were presented, either in drawing or models, but the choice was soon narrowed down to two forms, the column and the obelisk, and a new committee (H. A. S. Dearborn, Edward Everett, Seth Knowles, S. D. Harris and T. H. Perkins) was appointed to procure designs of both, with estimates of the expense of each. At the next meeting the majority voted that an obelisk should be used, and it was at this stage of the enterprise that the directors proposed to lay the corner stone of the monument. Ground was broken June 7, 1825, the Grand Master of the Grand Lodge of Massachusetts, F. and A. M., performing the ceremony. General Lafayette was present, and Daniel Webster delivered the address. The celebration was unequalled by anything of the kind that had been seen in New England.

At a meeting of the directors (June 24), the committee on laying the corner stone reported that a stone had been prepared to receive a box; that one containing a plate of silver with inscriptions had been deposited on the 17th, and that stones secured by iron clamps had been placed over it. This corner stone, however, was but a temporary one and was subsequently rejected. On the commencement of the work for the monument the box was taken out, put in the hands of Doctor Warren for safe keeping, and later placed in another stone—the real corner stone—which is in the northeastern angle of the structure and which was laid by Mr. Willard. On this plate the name of Alexander Parris is given as architect, which error has since been corrected by an inscription on the monument.

The plan submitted by Solomon Willard was accepted and a building committee, consisting of Doctor J. C. Warren, Amos Lawrence, H. A. S. Dearborn, William Sullivan, and George Blake, were after many difficulties appointed, and they, on October 31, appointed Mr. Willard architect and superintendent of the monument. When asked upon what terms he would give his whole time to the work, Mr. Willard replied that he thought that "the interests of the association would be best served by having the services gratuitous," but that three dollars per day would be sufficient if

payment was to be made. He finally accepted a sum "sufficient to pay his expenses."

Previous to his election, June, 1825, Mr. Willard wrote to Mr. Ticknor, giving his views as to the best manner of carrying forward the work:

"A Building Committee should be chosen who are favorably disposed to the design, and who will unite heartily in carrying it into execution. An agent may be employed to assist in making the contracts, and an architect, if his services are considered necessary. The services of the committee and agents should be gratuitous, as the honor of the employment should be a sufficient compensation. The committee should mature the designs in all their details. The form, dimension and tonnage of every block of stone in the structure should be known, and the management of the contracts should be the same as would be employed by an individual concern.

"After the dimensions and the quality and quantity of stock wanted are known it might be well to advertise for proposals for supplying it. I do not apprehend much difficulty in procuring any of the stone at a fair price, except the blocks for the outside, which being of considerable dimensions, and required to be of stock which is very valuable to those who have it, will probably be held very high. Should this be the case, it might be better for the association to buy the quarry and to employ a skilful superintendent to see the stone quarried. An experiment might also be made to ascertain the cost of dressing the stone per foot, that the committee may judge of the economy of having them done at the prison, and also to determine the probable cost of the work.

"It is estimated that the stock quarried would be worth twelve and a half cents per foot cubic measure at the quarry, dressing for twenty-five cents per foot superficial, including cost of tools, and twelve and a half cents for the beds. The transportation may cost \$2.00 per ton delivered at the Hill or State Prison.

"Taking a block of stone of mean dimensions of ten feet long, three feet wide and one foot six inches thick, it will contain forty-five cubic feet, which at twelve and a half cents per foot will amount to ..... \$5.62½  
 Thirty feet of face dressing, at 25 cents ..... 7.50  
 Thirty feet of beds, at 12½ cents ..... 3.75  
 Transportation of 3½ tons at \$2.00 ..... 6.50

Total cost per block ..... \$23.37½

"A stone of the given dimensions, according to the foregoing estimate, will cost \$23.37½, if it is transported in the usual way, but should a railway be constructed, as has been suggested, it may save much expense in so large an undertaking.

"The quarry which I mentioned the other day has been purchased expressly for the work, but if on examination the directors should not think it the most eligible, it will be no loss."

While the Board of Directors was engaged in devising plans to obtain the means wherewith to build the monument, Mr. Willard was seeking for a suitable material of which to construct it. He took care to inform himself on the subject of monuments generally, and especially of their peculiar characteristics, the nature of the material used and the manner of construction. Before the design of the monument had been decided he had been actively occupied in exploring the country in pursuit of a quarry from which could be obtained blocks of sufficient size for the purpose, and in a location to be made available with existing means of transportation. This was one of his most laborious undertakings in connection with the monument, and he was indefatigable in its accomplishment. Mr. Lawrence, secretary of the Building Committee, wrote in a blank leaf preceding the records of the committee, the following:

"Solomon Willard walked 300 miles to examine granite quarries (Hallowell, Maine, and other places), gave a thousand dollars to the Monument Association, and worked like a dog for the association for years for merely his necessary expenses (which were very small), and is now at work at Quincy. Boston, August, 1849."

The result of these journeyings was the selection of what was subsequently known as the "Bunker Hill" quarry in Quincy—a most fortunate selection, and one manifestly made with a wise judgment. A quarry was also purchased at Rockport, Massachusetts, by Mr. Amos Lawrence, where it was supposed peculiar facilities would be secured in shipping the blocks to Charlestown, but this was not considered as desirable as the quarry at Quincy, and was never owned by the association.

The quarry discovered by Mr. Willard was purchased in June, 1825, by Gridley Bryant of Frederick Hardwick and conveyed to him by deed dated the ninth of that month. The conveyance was of "all the rocks or stones on and in a certain piece of woodland, lying in the town of Quincy aforesaid, in the ——lot, so called, and was part of the estate of Nathaniel Savil, containing four acres, more or

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etc., and so bounded and marked as follows, viz.: Southerly on wood-and-stone wall of Captain John Hall, deceased, now owned by his heirs, Ebenezer Crane and George Nightingale; westward to the right and eastward in woodland of Honorable John Quincy Adams, and so westward bounded, as reported to be bounded, together with the privilege of taking away or removing said rocks or stones at any time necessary to suit said Bryant's convenience—and further it being understood by the parties that the said Bryant shall have the right to cut, bear or remove any of the wood or remove any other obstacle that may hinder or prevent the said Bryant from taking and cutting off the rocks or stone whenever he pleases on or about said land, and it is hereby agreed between said parties that all the wood that said Bryant shall cut or said lot shall belong to said Frederick Hartwick." The consideration paid by Mr. Bryant was \$500. The quarry was a little more than twelve miles from Bunker Hill.

In November immediately after the selection of Mr. Willard, and upon his recommendation, the quarry was purchased, and Mr. Bryant conveyed to the Bunker Hill Monument Association "the privilege of quarrying any quantity of stone which may be wanted in erecting said monument from a quarry which said Bryant purchased of Frederick Hartwick, in June last, the same lying in Quincy—in consideration of the sum of \$500."

The following advertisement was inserted in the Columbian Sentinel of November 11, 1825, by the chairman:

"Proposals will be received for furnishing the granite for an obelisk to be erected in Bunker Hill. The quantity required will be about 9,000 tons, and must be delivered at the prison in Charlestown or at a wharf near the navy yard, as may be required, the dimensions of the blocks to be about 2 feet 6 inches wide and 12 feet long. The granite for the foundation may be of a coarse kind, and it will require about 1,400 tons. The outside curves of the obelisk must be of the best Quincy granite, of uniform color, of which about 2,600 tons will be required. Proposals will be received for Chelmsford granite for the outer courses. Those who estimate may furnish any quantity to suit their convenience."

In commenting on the offer of the committee Mr. Willard said: "Most of the persons who furnish stone in this vicinity examined the designs accordingly, but offered no proposals. All wished to have the construction so altered as to use small stone. One offered

verbally to furnish a part at 62 cents per cubic foot. The majority, however, entered into a combination to compel the association to change the construction, and to come to their terms, as respect the price (as I was informed at the time, by one who had been initiated into the mysteries of the combination)."

The Building Committee, in their first report, speak of the purchase of this quarry as follows:

"On recommendation of the Superintendent, they then proceeded to examine a ledge of rocks discovered by him in the town of Quincy, and found there a magnificent range of granite containing materials inexhaustible, the use of which they immediately, for a trifling sum, secured for the benefit of the corporation.

"The design of the committee in making this purchase was to quarry the stone on account of the corporation, instead of buying it; and this mode they have the strongest reason to believe, will put it in their power to make a great saving of expense. Their intention at the time of the purchase was to have begun the cutting of the stone immediately, and they expected to have been able to convey it by land, a distance of two miles only, with greatest economy in the winter season, so that by spring a sufficient quantity may be ready at the water's edge, in Quincy, to be transported by water to Charlestown and afford materials for beginning the work and carrying it forward with rapidity. The quarry was accordingly opened and its excellence fully answered the expectations that had been formed."

It appears by later records and papers that Mr. Willard retained an interest in this quarry. When it was proposed to take the stone wanted from Pine Hill Ledge, in order to save distance and expense in the building of the railway, one of the conditions of the change required by Mr. Willard was the following: "First, it will be requisite that the railway company should refund the money which has been expended at Bunker Hill Ledge and pay me the fair value of my right in that ledge."

The change was not made. The quarry was opened and worked, and at the end of six months, with all the preliminary preparations, the committee say, "under the eye of the indefatigable Superintendent, more than 3,000 tons of stone have been split from the bed in form, and lie ready to roll down the railway as soon as it is open to them." The purchase of this quarry, according to Mr. Willard's calculations, fixed the cost of the material for the monument in the ledge at about a quarter of a cent per cubic foot.

The construction of this railway—the first in the United States—was due solely to the needs of the Bunker Hill Monument Association.

Gridley Bryant, who planned and built the famous Granite Railway, was born at Scituate, Massachusetts, in 1798. "Having," as he said, "a mechanical and inventive turn of mind," his mother apprenticed him at the age of 15 to a prominent builder in the city of Boston. He commenced business on his own account when he was 21 years of age, and from that time met with every success—his skill and industry securing for him many important contracts with the United States Government and private concerns.

With plans and drawings he, in the fall of 1825, consulted Messrs. Thomas Handasyd Perkins, David Moody, Amos Lawrence, William Sullivan, Solomon Willard and Isaac T. Davis, citizens of Boston, as to its completion. These gentlemen were not very enthusiastic over the idea, but being anxious to aid in the completion of the monument, consented to his seeing what could be done. After innumerable delays, during which many obstructions were placed in the way of their securing a charter by the legislature, the desired document was obtained March 4, 1826, the bill being passed by a small majority.

How completely uninformed the public mind then was on the subject of railways is well illustrated by the questions asked by the members of the legislature. "What do we know about railroads?" "Who ever heard of such a thing?" "Is it right to take peoples' land for a project that no one knows anything about?" These and similar objections were made to the projectors of the railway, and various severe restrictions were attached to it, in fact it probably would never have been built were it not for the munificence and public spirit of Colonel Perkins, as none of the first named gentlemen associated with him in the enterprise ever paid any assessments, and the entire stock of the company finally fell into his hands. But the charter, and subsequent events connected with it, gave the death blow to the great Massachusetts canal project, backed as it was by surveys and estimates, the reports of commissioners and the recommendations of the executive itself. A railroad party had now sprung up as opposed to the canal party, and Bryant's success in obtaining his charter for the smaller enterprise set a number of the members of the General Court to work planning more ambitious railway schemes.

Many of the inhabitants of Quincy, as well as individual owners of quarries, desired that the railway should run through the town to Brackett's Wharf in the "Point." This route they endeavored to have appear more feasible, as its construction would be attended with much less cost, and would be more favorable to the interests of those who were in possession of valuable quarries in the North Commons, where stone had been taken for years. They anticipated that this enterprise might enable the railway to absorb all the business by their facilities in cheapening the transportation of stone, and they would have to give up their business or construct a railway at their own expense, which, with their limited means, was too great an undertaking for them to accomplish. This, like another imaginary trouble, soon came to an end. Those who carried on the stone business in the North Commons were as successful as were those who transacted the same business with the railway.

At the time Bryant's work excited an almost unequalled interest throughout the country, and it is still mentioned in every school history of the United States as the commencement of an epoch. It was, in fact, a pioneer American undertaking, the originator of which had closely studied that English railway literature which was then coming into existence. Although Stephenson had already, in a rude way, introduced locomotive steam power in the Stockton and Darlington railroad, Bryant made no attempt at anything of that sort. Indeed, had he done so he would have ruined his enterprise.

Ground was broken for the Granite Railway, April 1, 1826, and on October 7 the first car passed over the whole length of the railway.

The following contract is of value and interest, being the one that brought into existence this railway:

"This agreement made and concluded this 27th day of March, in the year of our Lord 1827, by and between the Granite Railway Company, herein acting by Thomas H. Perkins, their president, on the one part, and the building committee of the Bunker Hill Monument Association, herein acting by John C. Warren, chairman of said committee, on the other part, witnesseth, that the said Granite Railway Company hereby promise the said John C. Warren, chairman as aforesaid, to receive on the said company's railway, during the year 1827, 3,000 tons of hewn stone, to be used in building the monument aforesaid; at such times during the said year as the said John C. Warren is the superintendent, shall offer to be carried, and not exceeding 30 tons in a day—and that said company will carry

the same hewn stone from the place where the same shall be delivered on the railway, to the wharf of the said company, and thence by water to Deven's Wharf, in the town of Charlestown, and there deliver the same onto the said wharf, the said Warren, or the Superintendent, or other agent of the said building committee, furnishing a crane, at the building committee's expense, properly prepared for hoisting the said stone from the said company's boats, onto the wharf, the said company in themselves to pay the expense of transportation from the place of delivery, which is to be on the Railway, and actually between the sides thereof, until the delivery on the said Devens' Wharf, with the use of the crane, to be by said company furnished. And the said company hereby promise to do the said carrying, with all reasonable care and fidelity, and without doing any injury to the stone, which can be avoided with due care and reasonable diligence.

"And the said company further promises, and assumes upon themselves to take, carry and deliver any quantity of stone daily, which the said Warren or the agent employed under him, or said committee may require, not exceeding 30 tons of stone in any one day.

"And the said John C. Warren, chairman of the said building committee, hereby promises and assumes upon himself, to pay the said company at the expiration of each successive three months, from the commencement of the delivery, at said Deven's Wharf, in Charlestown, the sum of 75 cents for each and every ton which shall have been delivered, in full, for the transportation from the place of receiving aforesaid, to the place of delivery aforesaid.

*Provided*, Always that in case the weather shall render it impossible on any day, or days, to effect a delivery, it shall be a sufficient performance of the contract to make the delivery as soon thereafter as can be done; and, provided, also, that the said company may deliver more than 30 tons in a day, if it shall suit the convenience of the said company or deliver more than 30 tons in any one day.

"In witness whereof the said Thomas H. Perkins, President, as aforesaid, and the said John C. Warren, chairman, as aforesaid, have interchangeably signed this instrument, on the day first aforesaid.

(Seal)

"T. H. PERKINS,

"President.

(Seal)

"JOHN C. WARREN,

"Chairman."

The first proposition of the railway company was to transport the stone from the quarry to the tidewater at 50 cents per ton, and from thence by lighters to the wharf at Charlestown, at 40 cents; but the contract fixed the price at 75 cents per ton for the whole distance. The contract was not a paying one for the railway company, as it cost them twice what they received for the work. Delays followed delays, and Mr. Willard and his contractor, James S. Savage, wanted to carry the stone by ox teams. But as the use of the railway was continued for years after by Mr. Willard himself, it was evidently found to be of value and a paying proposition.

At first the stones were conveyed by the railway to tidewater by horse power, when they were put on flat bottom boats, towed by steam power to Deven's Wharf, Charlestown, and thence carried to the hill on teams. But this repeated transfer defaced the stones so much that after a few courses of the monument had been raised they were teamed directly from the quarry to the hill. It was not until April 25, 1827, that a contract for teaming the stone from Deven's Wharf to the hill had been made with Thomas O. Nichols and John Pierce, the price paid being 43 cents per ton.

To complete their contract, that of carrying the stone from Milton to Charlestown, the company bought the little steamer Robin Hood for \$6,500, and two tow boats for \$1,000 each. This led the proprietors in time to branch out, and in the same year they purchased one of the granite ledges. This was extended until the railway enterprise became altogether subordinate to the quarrying interests of the company, as will be learned by reading an account of their business printed in another part of this history.

Writing to a friend regarding the road, Mr. Bryant said: "The deepest cutting was 15 feet, and the highest elevation above the surface of the ground was 12 feet. The several grades were as follows: The first, commencing at the wharf or landing, was 26 feet to the mile; the second, 13 feet, and the third 36 feet. This brought us to the foot of the table-lands that ran around the main quarry; here an elevation of 84 feet vertical was to be overcome. This was done by an inclined plane, 315 feet long, at an angle of about 15 degrees. It had an endless chain, to which the cars were attached in ascending or descending. At the head of this inclined plane I constructed a swing platform to receive the loaded cars as they came from the quarry. This platform was balanced by weights, and had gearing attached to it in such a manner that it would always return

(after having dumped) to a horizontal position, being firmly supported on the periphery of an eccentric cam. When the cars were out on the platform there was danger of their running entirely over, and I constructed a self-acting guard, that would rise above the surface of the rail upon the platform as it rose from its connection with the inclined plane, or receded out of the way when the loaded car passed on to the track; the weight of the car depressed the platform as it was lowered down.

"I also constructed a turn-table at the foot of the quarry, which is still in use (1859) as originally constructed. The railroad was continued at different grades around the quarry, the highest part of which was 93 feet above the general level: on the top of this was erected an obelisk or monument 45 feet high."

The first cost of the road's construction was \$50,000. It was built thus: Stone sleepers eight feet apart were laid across the track, and upon these wooden rails, six inches high, were placed. Upon the top of these rails, iron plates, three inches wide and one-fourth of an inch thick, were fastened with spikes, but at all the crossings of public roads and driftways, stone rails were used instead of wood. On the top of these were placed iron plates four inches wide and half an inch thick, being firmly bolted to the stone. The incline plane was built in the same permanent manner and had a double track. The gauge of the track was five feet. As the traffic was all in the direction of these grades, single horses would, of course, move with ease just as heavy loads as the structure could bear; the only difficulty being to retard the loaded cars going down and draw the unloaded cars back.

The first car built by Mr. Bryant cost \$600. It had a frame for a body, which consisted of three timbers extending longitudinally, and resting with each end on a cross bolster, to which they were firmly bolted. There being two of these bolsters, each resting upon and across a four-wheel carriage or truck, having centre plates and side bearings of iron, and secured in the middle to each truck by a verticle king bolt, to allow a horizontal swivelling motion between them and the bolsters, similar to the king bolt and bolster of a road wagon. Each car had wheels six and one-half feet in diameter, the load being suspended on a platform by chains under the axles. The platform was let down at any convenient place and loaded; the car was then run over the load, and the chains attached to it being inserted in eye-bolts in the platform, and raised a little

above the track by machinery on the top of the car. The loads averaged about six tons each.

Following the car came the trucks or four-wheel carriages, which were constructed with two heavy timbers, to each of which was bolted an iron axle-tree. The wheels were made of cast iron, with inside flanges and treads running upon edge rails. These wheels were about 18 inches in diameter, and revolved separately upon the fixed axles, and not in pairs with the axles, as in the cars now in use. The distance between the bearing points of the wheels was five feet in each truck, and about five feet between the trucks. Each truck had a platform covering of plank fastened to its frame. They had no pedestals or springs and could be used separately when needed as four-wheel cars. When stones of 8 or 10 tons weight were to be transported two of these trucks were attached by a platform and a king bolt, thereby making an eight-wheel car. When longer stones were to be carried the number of trucks was increased, by which arrangement a 16-wheel car was made. This was used to transport the columns for the Old Court House in Boston, each one weighing 64 tons in the rough. The main body or frame to connect the trucks, when used as an eight-wheel car, terminated about 18 inches beyond the middle of each truck. They had no projecting platform or bumper, and in the use of two such cars together their trucks would collide. These cars exhibited the swivelling principle of two trucks connected to one carrying body, adapted to transporting granite or other heavy bodies, and not suited to any other purpose. They were continued in use on this road for over a quarter of a century. Stone substituted wood as sleepers throughout the entire railway after a few years' use; the stone transverse sleepers that had originally been used were utilized, and they were in perfect condition up to within a short period.

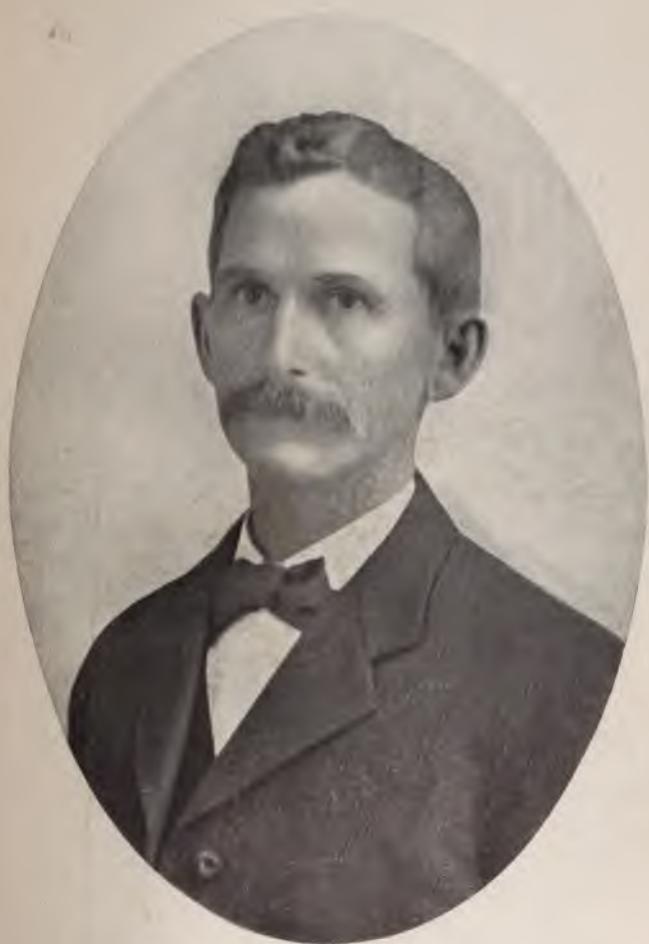
No attempt was made by Mr. Bryant to adopt his road to steam, he depending entirely upon horse power, so that in reality his was an improved tramway and not a railroad; but in this were embodied several inventions indispensable to the construction of railroads to-day. They were the switch, or gate (as it was termed), portable derrick, movable truck (for eight-wheel cars), turn-table and snow plow. In the suit of Ross Winans vs. the New York & Erie Railroad Co., the Bryant car was put in evidence against the validity of the Winans' patent, granted for the eight-wheel car on October 1, 1834. No railroad invention ever gave rise to more controversy than

this device, and in none was greater talent employed on both sides. About five years of time and \$250,000 were expended in the litigation before a final decision was obtained against the patent, and the immense claims, which would aggregate several millions of dollars, advanced under it. This decision, while it did not benefit Mr. Bryant pecuniarily, sustained his claim as the inventor of the eight-wheel truck. He died at his home in Scituate, Mass., June 13, 1867, aged 77 years.

July 25, 1832, the first railroad accident in the United States happened. Four gentlemen left the Tremont House, Boston, to go to Quincy to view the new railroad enterprise. After having examined the process of transporting large loads of stone they were invited to ascend the incline plane in one of the vacant returning cars. While the car was ascending, the chain gave way and they were precipitated over the precipice, a distance of 20 or 30 feet. Thomas B. Achus, of Cuba, was killed. J. Gibson, of Boston, had both legs broken. W. G. Bend, of Baltimore, was severely injured and Andrew E. Belknap, of Boston, slightly injured.

On April 16, 1846, the Granite Railway Company was empowered to extend its road beyond the terminus near the Neponset River; also to construct branches not exceeding one mile and one quarter each from any part of its railroad within half a mile of its own quarry to any of the neighboring quarries. It was also given a permit to transport freight and passengers and to increase its capital \$50,000, and was further allowed to sell its entire plant to the Old Colony Railroad Company. The road was purchased on March 31, 1847, by the Quincy Branch Railroad Company and incorporated on that day by Messrs. Octavius G. Rogers, George Penniman and Joshua Emerson, the capital stock being \$300,000.

The first year of Mr. Willard's services for the Monument Association was devoted mostly to preliminary matters. In reporting upon the work done, he says: "From a recent examination of the accounts kept at the ledge, it is ascertained that the whole sum paid out of the funds of association from November 15, 1825, to December 15, 1826, little exceeds \$10,000, of which \$348 has been paid for digging out the foundation in Bunker Hill; \$195 for four acres of land near the quarry, and \$712 for building a boarding house for the workmen. The quarrying apparatus has cost \$2,000, and is now on hand partly worn, but is probably worth two-thirds its first cost. It consists of lumber, iron, steel, hammers, bars, wedges, etc. The



JOHN C. BALLOW,  
*Quincy, Mass.*



PLANT OF DEACON BROTHERS, QUINCY, MASS.

house and land are probably worth what they cost. If we deduct the above from the sum stated, there will be left \$6,745, total expended in opening the quarry, making roads, quarrying and rough dressing 20,000 feet of foundation stone and 10,000 feet of fine hammering, to which must be added the cost of transporting 125 tons of stone to Charlestown.

"Much time has been necessarily spent in clearing and opening the ledge, making roads and much unnecessarily wasted by the delinquency of the railway company. The 20,000 feet of foundation, although but a small part of the work executed within the thirteen months, would come to more, at the prices charged for similar work at the prison, than the whole sum paid out."

After the blocks were split off from the ledge, means were required to raise them and transport them, and these had to be invented and constructed, as no machinery equal to the purpose and otherwise reliable, was then in use. The hoisting apparatus which was first required was provided by Almoran Holmes, and respecting him and if we may safely adopt the honest, generous and feeling language of Mr. Willard who knew and appreciated him.

Holmes' Hoisting Apparatus. "This was used for setting the first 55,000 feet of granite in the obelisk. (All the remaining stone was hoisted by steam power, and the same power was used for more than a year after the completion of the monument to carry visitors to the top, passing up through the cone.) This apparatus, with various modifications to adapt it to difficult purposes, appears to have been the original invention of Almoran Holmes, of Boston. He was a practical seaman, and a bold and skilful hand in this department of engineering. He had recently given his attention to the different kinds of machinery required for the hoisting of heavy weights, and from his early training was well prepared to direct in all difficult cases, and particularly where rope purchases were required. He finally lost his life by a casualty which occurred at Long Wharf, in Boston, in lowering a diving bell. He had the entire charge of contriving the apparatus and hoisting the first 36,000 feet of granite in the obelisk; but previous to the recommencement of the work in 1834, the fatal accident occurred, which deprived the association and the public of his invaluable services.

"The Hoisting Apparatus is remarkable for its compass, and the ease and grace with which it performs its work. With a gaff or arm, of 50 feet, it will command a circle of 100 feet in diameter.

It will take a weight at the point of the gaff and land the same at any point of the outer circle; or on any point of a concentric circle, until it arrives at the foot of the derrick, and vice versa. It is consequently well adapted to buildings of magnitude in setting the stone work, and for wharves and other places of deposit, in stowing the material in the most compact manner and reloading them when wanted. This apparatus, with some variations, has come into general use, and is so well contrived for the purpose intended as to leave little to be wished for in regard to apparatus for hoisting.

"Something of the kind is said to have been used at the Bell Rock Lighthouse for setting the stone work, and it is quite possible that the apparatus, and indeed every other modern invention for the purpose of hoisting may have been in use before. The great works of the ancients that have come down to us prove that they must have had an apparatus of great power of some kind, and it seems quite probable that this, as well as other inventions of modern times, may have been repeatedly invented and lost within the last 4,000 years."

Other machinery was required for the handling, lifting and hauling of the large blocks of granite from the Bunker Hill ledge for the monument, and the still heavier blocks which were subsequently required, from 10 tons to 100 tons, or even of 150 tons measurement. The machinery was furnished by Mr. Willard, and we copy his drawings and his brief and modest account of them:

"The Lifting Jack has been found to be a useful machine for turning heavy blocks of stone. It is a compact and powerful machine, calculated for hard service, and for some purposes seems to be better adapted than any other power. It consists of a rack, and one or more wheels and pinions, according to the power required.

"Something of the kind had been in use from the earliest times, but was not used in the granite business until the work on the monument was commenced. These in use were constructed for other purposes and not adapted to hard service. They were generally made of thin plates of iron, bolted to a large stock of wood, having a feeble rack and without proper boxes for gudgeons. They were also weak and of rude workmanship, and when put to hard service either broke or were down and out of gear in a short time.

"In order to adopt it to hard service, thicker plates were used, and these plates were screwed to a hoop of iron. This iron hoop extended to the foot of the Jack, and the foot was bolted on, giving the whole a firm bearing on the ground; a piece of wood was bolted between the sides, leaving a groove for the sliding of the rack.

"It was considered important that the best of materials should be used, in order to obtain the greatest strength with the least weight. And, consequently, the whole was made of the best of wrought iron and cast steel, except the boxes, which were of bronze or composition. The rack and the wheels were of wrought iron, and the pinions of cast steel.

"The Pulling Jack is constructed much like that for lifting, but is always in a horizontal position. The crank pinion is two or three feet, and turned by four arms about three feet long. The rack has a claw at the end to receive a chain, which may be led to places inaccessible and dangerous for using the common jack. It is a powerful and convenient purchase for carting and hauling out heavy blocks of stone.

"The power of the one used is about 10 tons; but by the addition of a shieve the power is nearly doubled, amounting to nearly 20 tons. If more is necessary it is obtained by adding another jack. This machine was contrived and first used at the Bunker Hill quarry.

"The Hoisting Apparatus was contrived at the Bunker Hill quarry, and first used in loading a large mass of the granite for the obelisk. It is calculated for raising weight too heavy for shears or derricks, and has been found convenient for loading any stone from 5 to 50, or even 60 tons in weight. A horse, or timber frame, is set over the stone to be raised, supporting a screw and nut. A chain from the weight leads to a shackle, which is connected with the screw. The nut is then turned round by long arms, and the weight raised to a proper height for the carriage to pass under it, and when properly adjusted the weight is lowered to its bearings.

"For blocks of granite of great length, such as columns and pilasters, etc., two horses and screws were used. In unloading the same the apparatus was placed over them, and the weight raised sufficiently to clear the carriage. The carriage was then drawn out and the weight then lowered to the ground. Many hundreds of loads have been raised in this way without accident and with facility and economy."

These several machines were continued to be used for many years in Quincy, and Holmes' derricks towering over the ledge were the most conspicuous objects in that section.

The wagon was constructed to carry columns from the Merchants' Exchange in New York, and later the pilasters for the new exchange in Boston, and a part of the columns at the Custom House.

The corner pilasters at the Exchange were about 55 tons in weight, and for this purpose four additional wheels were connected and the four fluted pilasters were carried in two carriages of four wheels each. The axles of the forward carriage were made about 20 years earlier for transporting the columns of the Branch Bank from Westford to Boston, and afterwards for carrying the four columns at the meeting house in Quincy. The axle of the hind wheels were six inches in diameter, that of the middle wheels five inches and of the forward four and one-half inches.

The experiments instituted by Mr. Willard at this time to ascertain the cost of dressing the different blocks of stone, net measure whether circular or straight, and allowing two feet of coarse dressing for one of fine dressing, resulted as follows: "433 feet quoin and hollow cone, 36 cents per foot; 81 feet platform and steps, 3 cents; steps jobbed out in winter, 26 cents; large quantity of hollow cone by sundry persons, 30 cents—average 32 3-4 cents per foot, which 6 cents per foot may be added for tools."

With a liberal disposition to assist in the erection of the proposed monument the legislature passed a law February 26, 1825, authorizing the association "to have the stone of which their intended monument may be constructed, hammered and prepared to be used at the State Prison in Charlestown, provided that the hammering of stone under the provisions of this section shall never exceed in value the sum of \$10,000. But in 1827 the association petitioned the legislature for the amount in money instead of prison work. For the purpose of this hearing Mr. Willard estimated the rough blocks to weigh 25 per cent more than when dressed; the delay in passing the draws of two bridges at 5 per cent, allowed considerable expense for extra apparatus for handling and loading the large blocks at the prison, and concluded his statement with the following "Recapitulation":

"The first and second items make the extra expense of transportation 30 per cent., and the third, fourth and fifth cannot amount to less than five, making the aggregate extra expense of transportation at least 35 per cent.; besides the great delay in the prosecution of the work which must inevitably ensue from this mode of carrying it on. From items six and seven it appears that the difference of cost in hammering the blocks at the quarry and at the State Prison, taking 30 cents as the mean price per square foot at the former, is as 30 to 210, or as 1 to 7."

Compromise was made and the legislature gave \$7,000 in cash to the association. Therefore it is a satisfaction to say that this monument to freedom was not cut by men in bondage.

After vexatious delays work was begun, and the following report of Mr. Willard, July 18, 1827, is of particular interest:

"The work is now in favorable course of prosecution; the daily expenses at the quarry are for 27 men, \$42.98; for tools, including the steel, coal and time of the blacksmith, \$8.33; together \$51.31. This gang of men will get out one course of the monument in twelve days. The first course of stone will contain 124 tons, the blocks being four feet and four inches, in which are 1,619 feet 3 inches of hammering, including the hollow cone. The average contents of the first eight courses is 120 tons, and the expense of a course may be calculated thus:

|  |          |
|--|----------|
| Say for 12 days' work at the quarry at \$51.31 per day is..            | \$615.72 |
| Transportation to Deven's Wharf at 75 cents.....                       | 90.00    |
| Transportation from wharf to the hill at 48 cents.....                 | 57.60    |
| Expense of laying, including everything, at 66 2-3 cents per ton ..... | 80.00    |
|  | _____    |
|  | \$843.32 |

Mr. Willard was paid for his services from November 9, 1825, to June 17, 1827, \$800, and he subscribed to the funds of the association \$1,000, the amount he received from the railway company for his right in the quarry, which sum was expended by him in his explorations for a quarry.

At the close of the work for the year, November, 1827, Mr. Willard sends this interesting report:

"It may be seen by the roll which I wish the committee to examine, that the number of working days, from the 16th of July to the 17th of November, inclusive, amounts to 108. The whole number of days of labor, done in the hammerers' department at the ledge during that time is 2,257—equal to 20 and 97-108 day's work each day. If the time spent in fitting the stone on Bunker Hill, viz., 181 days, be taken into the account, it will increase the average per day to 22 and 62-108.

"By the roll it will be seen that the average labor on the ledge during the same period of time has been only 6 and 38-108 days' work, having been performed by three splitters and three capstan

men. In the 108 days referred to these six men have split and run down 180 blocks of stone, which will average over six tons each after having been dressed; and they have also split and run down 180 blocks for skirting and hollow cone, which will average two-thirds of a ton each, besides clearing away the cellar and wharf stone, which though valuable to those who come after, is waste to us. In the description of the work that has been quarried at our ledge, there is much greater difference in the tonnage, before and after being dressed, than usual. I should think that the difference, including the cellar stone, would amount to one-third of the whole.

"The large and small blocks together amount to 787 tons, to which if we add 393 for loss of tonnage in dressing and for cellar stone, the whole number of tons will be 790, quarried and delivered by six men in 108 days; equal to eleven tons per day for 108 days in succession. The expenses of the six men to the association were \$10.45 per day, which sum, divided by eleven, the number of tons got out daily, gives 95 cents per ton. Then the cost per ton divided by 13, the number of cubic feet in the ton, gives 7 cents and 3 mills for the cost per cubic foot for the rough stone.

"Our stock, according to the last experiment, costs us 10 cents per cubic foot, measured after it is dressed. Then if we add 9 1-2 cents for carrying, it will amount to 19 1-2 cents per cubic foot delivered on Bunker Hill. I do not know that stock as good could now be obtained at any other place within 20 miles of Boston for four times this sum. The original estimate was 16 1-4 cents and with the facilities anticipated I have no doubt the actual expense would have corresponded with the first estimate."

From another item contained in the same report we get some idea of the kind of workmen the superintendent had with him at the ledge:

"For executing the work I have thought it the best policy to hire good men, to pay them fair wages and to see that their labor is well divided. In this way you can obtain good men and keep them, and by using the proper means to excite emulation, they will not only be faithful but the work will go on with a spirit and economy which cannot be obtained in any other way. No graduate from our penitentiary or foreigner has been employed. The workmen are Americans; natives of neighboring States. Some are relatives of those who fought on Bunker Hill and inherit a genuine spirit for the work. Thus far there has been an uncommon degree of harmony

among them. In a few instances I have discovered a disposition in some to tyrannize, which I have thought proper to discountenance. It seems to me an improper place to act the Bashaw, the slave or the sycophant. The work which we are engaged in is a work of patriotism, where all should be on equal terms."

The work was divided into five departments, viz., the Quarrying, Hammering, Carrying, Hoisting and Masons' Departments. The number and cost of the men who filled the various departments were as follows: Quarrymen's department, 1 master at \$2, 5 common hands at —, 3 capstan men at —, 1 blacksmith at \$1.67.

Hammerers' Department: 30 hammerers at \$1.75; 2 blacksmiths at \$1.67; one patternmaker at \$1.19.

Hoisters' Department: One rigger —, 1 master at \$2, 1 foreman at \$1.67, 3 common hands \$4.50.

Masons' Department: One master mason at \$2.50, 3 journeymen at \$1.67, 1 apprentice \$1.00, 1 blacksmith, 1 tender.

The work now encountered obstacles which it took years to overcome. It would require too much space to give the dark side of its history, to detail the measures in order to raise the required funds that were suggested, attempted and abandoned. Work was stopped, Mr. Willard and his assistants discharged, and that part of the monument completed (about 37 feet) was boarded over. Finally the Massachusetts Charitable Mechanics' Association began a campaign of collecting funds. Mr. Willard was employed to lay out streets bordering on the sides of the monument, which were divided into house lots and sold at auction, for which \$25,000 was realized. The Mechanics' Association collected \$18,073.03. "The Ladies' Fund" amounted to \$2,937.90, and work was again begun. Mr. Willard was employed in his former position, and Charles Pratt was engaged as master mason, although Mr. Savage was still employed by Mr. Willard. The monument was built to a height of 82 feet. Then the funds became nearly exhausted. At this time Amos Lawrence and Judah Touro of New Orleans gave \$10,000 each to the fund, and the fair held by the ladies of Boston from September 5-15, 1840, netted \$30,035.53. Fanny Ellsler, the noted danseuse at a benefit in Tremont Theatre, also raised over \$1,000, while funds from other sources swelled the total, January 14, 1841, to \$55,153.27. Measures were now promptly taken to complete the monument. They contracted with James S. Savage to finish the work. The expense was paid by the contractor as follows:

|  |             |
|--|-------------|
| To D. M. C. Knox, for granite, etc.....  | \$1,725.12  |
| To Rogers & Richards .....               | 11,021.00   |
| To Josiah Babcock.....                   | 856.91      |
| To Wright & Barker .....                 | 7,136.32    |
| For superintendence .....                | 1,853.50    |
| For drawings, bevels, patterns, etc..... | 263.87      |
| Cost of setting stone .....              | 4,160.00    |
|  | <hr/>       |
|  | \$27,016.68 |

He was paid by the association \$43,800 cash, also about \$4,800 in tolls from visitors viewing the work, besides apparatus valued at \$1,400, amounting in round figures to \$50,000, which if the entire monument was paid for on this basis would cost \$200,000 or twice that which was actually paid for the work.

Work was recommenced May 2, 1841, and steadily prosecuted until its completion. The last stone was raised in the morning of July 23, 1842. Edward Carnes, Jr., waving an American flag, accompanied the stone in its ascent, and salutes were fired from the Charlestown Artillery. A little time previously a cannon had been raised to the top and a salute fired from it. In 1843 another splendid pageant took place and Daniel Webster delivered the masterly oration.

In 1834, Mr. Willard wrote a long letter to the association in regard to costs, a part of which we quote:

"The quantities of stone and dressing that have been delivered are already known by actual survey. According to Loring's measurement there are 57,802 feet of stone, cubic measure, already split out and a larger part delivered on Breed's Hill. The market value of such a lot of stone, I shall estimate at 75 cents per cubic foot, and the whole amount to \$43,351.50 at that price. The number of feet of dressing, according to the same survey, and measured in the customary way, is 52,568 feet, superficial measure. The average price of first rate work, for 15 years past, is assumed to be 50 cents, and the whole will amount at that price to \$26,284.50. The number of cubic feet laid up, according to the same survey, is 35,878, and the market price per foot is assumed to be 30 cents, including the fitting, hoisting, laying, mortar, iron cramps and scaffolding, with the wear on the machinery and every other expense connected, and would amount at the above price to \$10,763.40—and the total amount of the three items at the assured prices would be \$80,399.40.

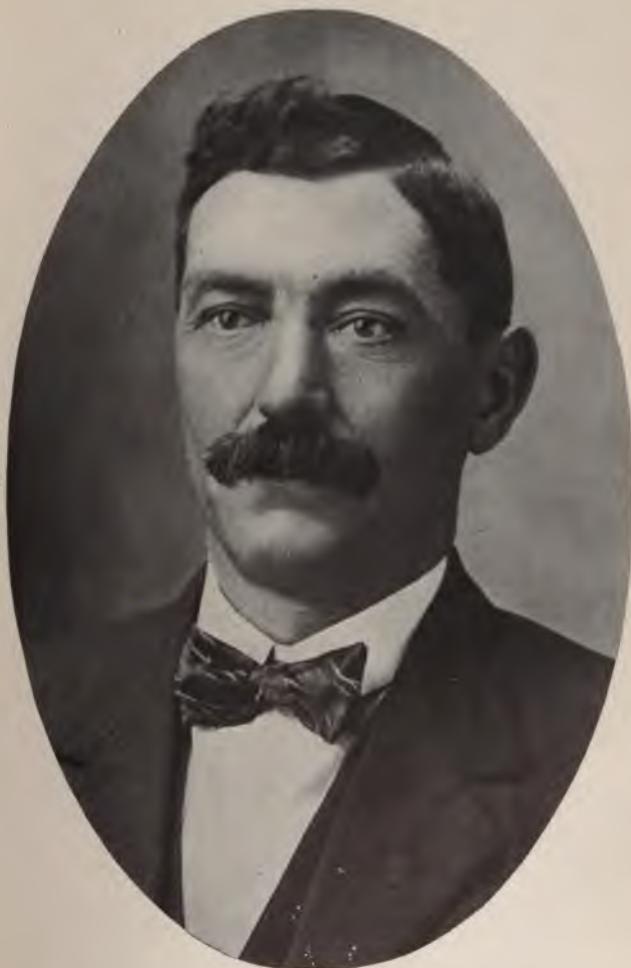


PLANT OF HENRY C. SMALLEY GRANITE COMPANY, INC., QUINCY, MASS.



HENRY C. SMALLEY,

*Firm of Henry C. Smalley Granite Company, Inc.,  
Quincy, Mass.*



ANDREW MCINTOSH, JR.,

*Firm of Henry C. Smalley Granite Company, Inc.,  
Quincy, Mass.*



SOLDIERS' MONUMENT, BROCKTON, MASS.

*Cut by Long & Saunders, Quincy, Mass.*

"The question to be settled is whether the assumed prices are on an average of those paid for similar work for the last 15 years, or whether they are above or below the current prices.

"In order to ascertain this it will be necessary to refer to the bills paid for similar work at different places, and in relation to the cost of the stone, of the dimensions of these used at the monument we may refer to the bills paid at the Massachusetts General Hospital for the blocks which compose the columns, and to those paid at the Branch Bank for the architrave pieces, and the blocks for the columns which were originally intended to have been in five pieces, and for which contracts were made. We may also refer to the bills paid at the Tremont House for the blocks for the columns to the portico and in the cornice; and to those paid at the Washington Bank for the footings to the columns, and at the Arcade in Providence for similar pieces. We may refer to the bills paid at the dry docks in Charlestown and Norfolk for a large number of blocks of a corresponding size, and to those paid at the new bank now erecting on State Street for the piers that support the columns. And also those that are to be paid at the new Court House [in Boston, recently taken down] for a large quantity of work about to be contracted for and to any bills which may have been paid for blocks of four tons weight sold in the market within the time specified.

"In order to ascertain the value of the dressing of first rate work we have only to refer to the prices paid at some of the principal buildings that have been erected, viz.: To those paid at Mr. Sears' house (Beacon street) for straight and circular work; to those paid at the Tremont House, at the Theatre, at Mr. Webster's house, at Mr. Cushing's, at the New Court House, at the new bank, at Astor's Hotel [Astor House, New York City], etc. The market value of the mason work may be found in a similar manner, and a bill in the form of an account current, including the three items above named at the prices found, would probably stand as follows:

(We omit the form of account mentioned as being simply a recapitulation of the above statements.)

"Allowing the prices assumed to be the market prices, the above bill shows that the work already done would have cost the association the sum of \$80,399 had they paid the current prices, a sum far exceeding the one actually paid out.

"There are still nearly 34,000 feet of stone required to carry

the monument to the height proposed (221 feet 5 inches), for which the association would have to pay the market price were they excluded from the quarry they now possess, and from other advantages derived from the exertions of those who have been ~~ear~~ engaged.

"The current prices may be found as in other cases, namely by collecting an account of sales for the time specified. With respect to ascertaining the prices which have been paid for the dressing and masons' work there will be little difficulty. The price paid for blocks of granite of the dimensions used at the monument will not be easily ascertained, as care has generally been taken to conceal the amount paid. This has been accomplished either by secret contract, or evasive answers, or by 'lumping' the high and low-priced stone together. The prices which have been paid per cubic foot at the different places referred to are supposed to nearly as follows:

|  | Per cubic<br>foot |
|--|-------------------|
| At the General Hospital, for columns.....        | \$1.00            |
| At the Branch Bank, for architrave.....          | 2.00              |
| Which were to have been paid for columns.....    | 1.00              |
| At the Tremont House, for columns .....          | 1.00              |
| At the Tremont House, blocks for cornice.....    | 1.00              |
| At the Washington Bank, per footing.....         | 1.00              |
| At the Arcade in Providence, per footing.....    | 1.00              |
| At the Dry Dock, in Charlestown .....            | 1.00              |
| At Norfolk for Dry Dock.....                     | 1.00              |
| At the New Bank on State street, for piers ..... | 1.00              |
| For the New Court House .....                    | 1.00              |

Average price of these sales, 99 cents.

"It will be observed that the average of the above sales is higher than the one assumed in the account."

In another section of the report he says: "The preparation for commencing the work of building the monument required considerable expenditure. At Breed's Hill [Bunker Hill], the preparation consisted in sinking a foundation nearly 50 feet square and 12 feet deep, and laying an inclined plane of flagstone from the road to the monument to facilitate the drawing up of the large blocks of granite which it would have been difficult to do on the soft ground. The prosecution of the work required also an expen-

sive hoisting apparatus, with substantial guy posts planted deep in the earth and ballasted. A capstan house was also necessary, with sheds and blacksmith shops, and various sets of tools, jacks and other apparatus. A hoisting apparatus was also found necessary at the wharf, where the stone was landed.

"The preparation at Quincy consisted in clearing and opening the quarry, making roads, erecting a boarding house, blacksmith shop, stone cutters' sheds and other buildings, a timber run and machinery for lowering the stone. And there was a large quantity of quarrying apparatus wanted, consisting of jacks, iron bars, sledges, hammers, etc., the greater part of which are now on hand.

"The cost of labor and wear of apparatus per foot for the work already performed has been found by experiment to be 73 cents, namely, cost of quarrying per foot measured after the blocks have been brought to form, 10 cents; cost of transporting from the quarry to the site of the monument, 9½ cents per foot; the cost of dressing 11-15 feet (being the quantity on each foot cubic measure), was about 37 cents, and the cost of fitting, hoisting mason work, mortar, iron cramps, scaffolding, etc., per foot, has been 16½ cents. This has been ascertained by dividing the whole sum paid out by the whole number of cubic feet laid up, according to Loring's survey. The contingent expense per foot was 20 cents, making a total expense laid in the work of 93 cents."

In his book, "Plans and Sections of the Obelisk on Bunker Hill," Mr. Willard says:

"There were forty-four blocks of stone of five tons weight in the first course alone, and it was found by calculation that five tons was a little more than the average size of the stones composing this structure. The average size was consequently nearly equal to the architrave pieces at the Branch Bank, and had the same price been paid for the stone in the obelisk that was paid for that at the bank, \$5.00 per foot, the granite alone would have amounted to an enormous sum."

The market prices for granite remained pretty much the same from 1810 to 1840. The following were the railway prices for 1836, for stone delivered at the landing, namely, posts and lintels, and other stone of cubic dimensions, 57 cents per cubic foot, and the price to increase one cent per foot on all stones that contain more than 25 cubic feet. Three cents were added instead of one as the cubic measure increased five feet. Therefore, the price of a block

of granite of 25 cubic feet was 57 cents per foot, and a block 26 feet, 58 cents per foot, and so on. The tariff of prices for exterior of the Custom House, as delivered in Boston, was 50 cents per foot for a stone of 25 cubic feet in content or under, and increase one cent per foot for each additional foot in size:

|                                 |                 |
|---------------------------------|-----------------|
| For cutting first quality.....  | \$3.00 per foot |
| For cutting second quality..... | 1.90 per foot   |
| For cutting third quality.....  | 1.10 per foot   |
| For cutting fourth quality..... | .50 per foot    |
| For beds and builds.....        | .25 per foot    |

Sixteen full columns, including capitals, 32 feet high, 5 feet inches in diameter at the base, delivered in Boston, cut and finished complete, \$5,100 each; sixteen three-quarter columns, \$3,700 each. At these prices the former would bring the cost of a block of 5 cubic feet, which is about the average size of these in the obelisk, at \$1.01 per foot, and by the latter at 79 cents, and a mean between these prices is 90 cents, which was in 1848 about the market price for granite of such dimensions.

At this price the cost of the granite blocks would have amounted to over \$78,000, and the whole cost of the monument over \$250,000. (The total cost of the obelisk was \$101,688.) And this sum would have been a reasonable estimate for the work at the time, considering the condition of the granite business and the state of the market. But had the monument been completed in the course of about three years—which would have been a reasonable time—it would have made a great difference in the final cost.

"It is found by comparison that the Washington Monument in Baltimore, Md., contains but about half the number of cubic feet of material that are in this obelisk. It consists of a column of about 19 feet in diameter at the base, set on a pedestal, and altogether about 160 feet high. It is well executed but of cheap construction. The foundation is of slaty granite, in small pieces, and the body of the work is of bricks, faced with limestone, and in ashlar courses of about one foot rise. And, notwithstanding, has cost, as stated on good authority, about \$220,000. And, consequently, has cost \$20,000 more than twice as much as the obelisk.

"It will be seen also that the obelisk will compare still more favorably with the work at the Custom House in Boston. It appears by the debate in Congress that this Custom House, which is pre-

sumed to contain about an equal quantity of granite with the obelisk, has already cost the sum of \$700,000, and requires \$300,000 more to complete the work. And it is presumed that the columns and pilasters along which are attached to the body of the work, have cost as much as two such obelisks."

Is it any wonder then that Amos Lawrence recorded in the records of the Monument Association "that posterity is more indebted to Solomon Willard than to any other man for the monument."

Measurements of Bunker Hill Monument:

Dimensions of the Obelisk.

|   |               |
|---|---------------|
| Height of obelisk to base of pyramid.....                         | 208 ft. 5 in. |
| Height of the monument to the apex.....                           | 221 ft. 5 in. |
| Sides of the square first course.....                             | 30 ft.        |
| Sides of the square at base of pyramid.....                       | 15 ft.        |
| Thickness of wall at the base, one-fifth.....                     | 6 ft.         |
| Thickness of wall at the top.....                                 | 2 ft.         |
| Circumference of chamber in the top.....                          | 36 ft.        |
| Height of chamber.....  | 18 ft.        |
| Diameter of chamber.....  | 11 ft. 6 in.  |
| Height of each course in the monument.....                        | 2 ft. 8 in.   |
| Dimensions in each course.....                                    | 2½ in.        |
| Number of courses to base of pyramid.....                         | 78            |
| Number of steps in the circular stairs.....                       | 294           |
| Height of riser.....  | 8 in.         |
| Foundation, 50 feet square, 6 courses, 2 feet each, 12 feet deep. |               |

Dimensions of the Cone.

|  |                    |
|--|--------------------|
| Height of the cone, from the flooring..... | 196 ft. 9 in.      |
| Diameter of the first course.....          | 10 ft.             |
| Diameter of the top course.....            | 6 ft. 2 in.        |
| Thickness of wall, at base, one-sixth..... | 1 ft. 8 in.        |
| Thickness of wall, at top.....             | 1 ft.              |
| Height of each course.....                 | 1 ft. 4 in.        |
| Number of courses.....                     | 147 ft.            |
| Diminish in each course.....               | 6-10ths of an inch |

Dimensions of the Pyramid.

|   |        |
|---|--------|
| Vertical height from base line to apex..... | 13 ft. |
| Number of courses in the pyramid.....       | 6 ft.  |
| Sides of the base.....                      | 15 ft. |
| From the base line to apex.....             | 15 ft. |

An art critic has this to say of the monument: "It is a of national reputation which owes more of its prestige to its di sions and the historical importance of the event it commemmec than to its artistic qualities. The real beauty of the ancient Egy obelisks, in which this column and many other modern one: meant to be modelled, consisted in the purity of their proport the subtle and graceful curving lines of their profiles, and decorative character of the inscriptions or hieroglyphics v covered their faces. We find none of these attributes in the modern obelisks (except Mr. J. Ph. Rinn's noble Battle Monu at Bennington, Vt.), and consequently what dignity it poss is mainly due to its height, which is becoming less wonderful "tall buildings" came in. Its outline is straight, hard and The gray granite takes the sunlight handsomely, however, at certain angles of light the column has a pleasant effect of buoy Anyone who has seen it with a distant thunderstorm in the ground, and with the rays of the sun shining upon its face, easily be pardoned for supposing that it is a satisfactory wo art. But, considered in cold blood, it is rather one of many inst of wasted opportunity, of the unintelligent adaptation of an an motive, stripped of its most essential artistic features and mag in bulk."

The objects and purposes for which Mr. Willard avo engaged in the granite business naturally excited the oppositio ill-will of all his competitors, and it is not strange that they sh have endeavored to keep up the price of their work to a standard, not by any direct "combination," as he supposed, but common personal interest. They looked upon his course with ousy and suspicion, and his proceedings as inimical to them, al doubt said harsh things about him. But it probably never occ to him that in furnishing granite to builders at the prime derived from an average, he was doing a wrong to those eng in the same business who were dependent upon a reasonable on their labor.

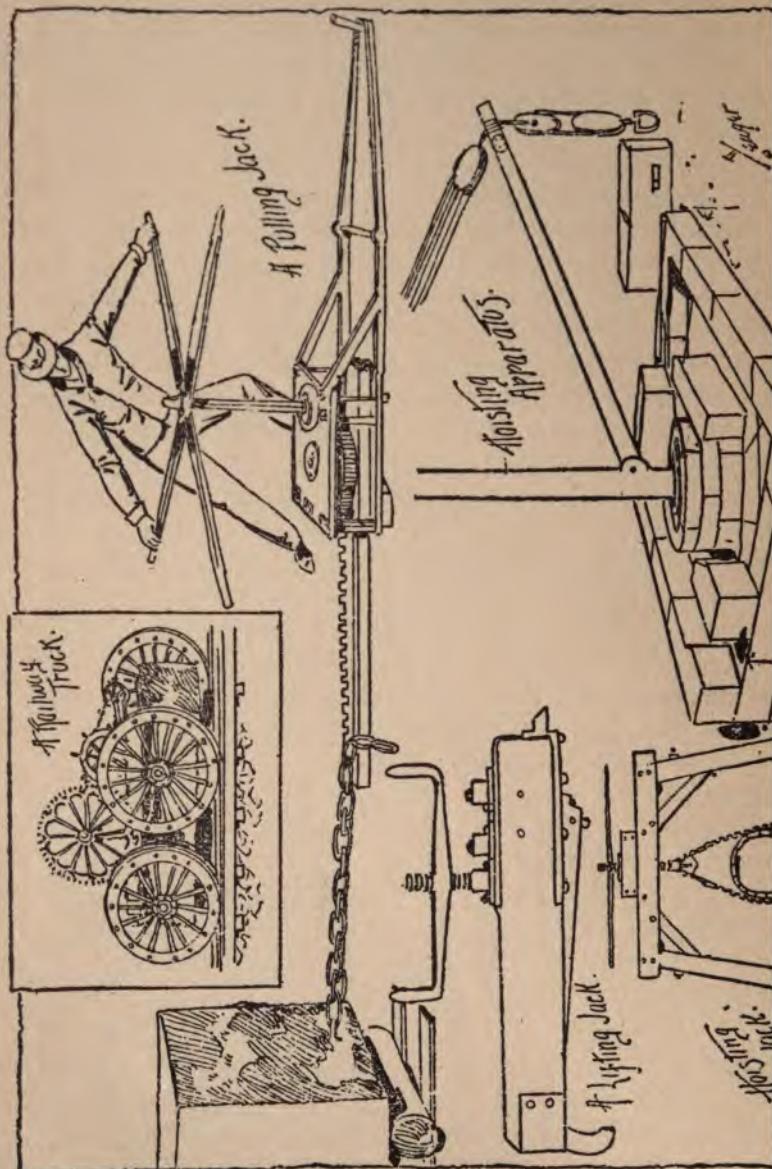
Not seeing the matter in this light he continued his effo increase the demand for granite, expecting that all parties v find their interests ultimately in small profits upon large sales. success of his efforts—his almost alone—in introducing the use of granite as a building material, as seen at the time i public and other buildings of Boston, New York, Philadelphia

other cities—all subsequent to the commencement of the monument—is the incontestible evidence of his sagacity and foresight. The opening of the Bunker Hill quarry led to the discovery and opening of other quarries, and gave an impulse to business which adorned our cities with a class of splendid and substantial building and which has gradually extended in scope to the vast business it enjoys today.

In a letter written in 1831, he wrote as follows:

"The high price demanded for granite for fifteen years past, and particularly for blocks of large dimensions, has had a tendency to discourage the use of it, and my object in engaging in the stone business was not to make money, but to make experiment in order to remove the obstructions to the extensive use of granite as a building material, and to ascertain the lowest price at which it could be afforded with the common facilities for doing business. I left the profession of architect, which I had followed ten years in Boston, and took charge of a corps of quarrymen, at the Bunker Hill quarry in Quincy, six years ago the 15th of the present November. The committee of that work had previously advertised for proposals for furnishing the stone required, and received but one, and that was 62 cents per cubic foot, for the raw material delivered in Charlestown. A combination had taken place among the dealers in stone to keep up the prices, as is usually the case. The quarrying of 4,000 tons was finally done by the day, by men under my charge, and cost the association but thirteen cents and three mills per cubic foot, delivered on a wharf in Charlestown. Since the work has been discontinued I have been making experiments at my own expense. While I conducted the work my services were gratuitous, and since doing business on my own account, I have merely charged my employers for their work what I suppose would be the prime cost, well managed, taking all risk on myself, without any compensation for the excessive labor and anxiety that I have had on their account."

In 1831, application was made to him to furnish granite for two houses in New Bedford, Massachusetts, and he proposed to deliver it on a wharf in Quincy, in 8-inch ashlars, at 15 cents a foot, and he made up the account of cost as follows: For bankage, one-quarter cent; quarrying, four cents; dressing edges, seven cents; transportation, two and three-quarters cents; profit, one cent; total, fifteen cents. The cost of stone cornices, with three cubic feet of



stone and seven feet of dressing, ... stated at \$1.74 per running foot. These prices were scarcely up to the prime cost of the article at that time; were manifestly too low to be a safe guide to other dealers, and however intended, were in some degree unjust to them.

Granite as a building material, excepting in a few instances, and those mostly under his superintendence, had been used in small pieces, or blocks of moderate size, for cellar walls, underpinning, posts, lintels, etc., and his first measure was to introduce the material in large blocks, such as were in themselves massive and durable, which as he saw at once, would absolutely necessitate changes in the style of architecture and in the character of public buildings, stores and other substantial structures. A sample of the small blocks may be seen in the front of Saint Paul's Church, Boston, and the larger ones in the Custom House, and both together, the large above the small, make an awkward appearance in the Navy Yard wall, Charlestown.

A good deal of feeling was manifested when he determined that such blocks should be provided for the Bunker Hill Monument, because no one of the dealers in granite was prepared to furnish them—neither to quarry them, to manipulate or to transport them.

After the completion of the monument Mr. Willard wrote:

"There are other important considerations connected with these experiments, however, and advantage growing out of them only secondary to the main purpose, namely, the effect they have had in improving the style of building material not before in use, and showing that it can be worked into any moulded or ornamental form required for the exteriors of the best structures, and at a reasonable rate, and thereby having supplied a desideration which had always existed until the commencement of these experiments.

"In a pecuniary point of view these experiments have also been advantageous. In establishing the credit of a new building material it created a new demand, and consequently a business has grown out of them since the work commenced, and in a space of a few miles, amounting, as estimated, to \$3,000,000, which would not otherwise have been done at these quarries, and of which the work on the obelisk is but about one-thirtieth part."

Mr. Dearborn, in his "Boston Notions," published in 1848, mentions thirty or forty new blocks of stores and single buildings,

all of granite or of granite fronts, one of which, that of Benjamin in Loring, State street, was erected in 1823, and is probably the first store to be built of this material. A. J. Allen's store, State street, was erected in 1827; the Masonic Temple, afterwards United States Court House, Tremont street, and a granite block on Washington street, in 1831; a block on Washington street, in 1832; Amory Hall Block, 1835; Lawrence Block, Milk street, 1844; the Cruft, Oregon, Quincy and Brooks Blocks, Pearl street, 1845-6-7; Bowdoin and Morton Blocks, Milk street, 1845; Old South Block, 1845; Horticultural Hall, School street, 1844; Sewell Block, Milk street, and Sanford Block, Franklin street, 1846.

## CHAPTER III.

SOME FAMOUS STRUCTURES OF QUINCY GRANITE.—PIONEERS IN THE  
WORK AND THE EXTENT OF THEIR BUSINESS.—BUILDING  
MINOT'S LEDGE LIGHTHOUSE.

THE United States Branch Bank, on State street, Boston, which was designed and built by him was completed before the work on the monument was commenced, July 5, 1824. columns in the portico of this building were cut from a huge boulder of granite in the town of Westford, Massachusetts, known as the Chelmsford granite. They were 24 feet in height, including the cap, and four feet in diameter at the base, being six-diameter columns. The plan of the monument at Concord in commemoration of the fight at the "old North bridge" was furnished at the request of Edward Everett in 1836. The Norfolk County Court House at Dedham was designed by Mr. Willard and erected in 1826. It was constructed of granite found in the immediate vicinity. It was universally regarded as one of the finest and best specimens of architecture in the country. The Franklin Monument in the old Granary Burying Ground was erected in 1827. It is of pyramidal form, composed of several blocks taken from the Bunker Hill quarry. The design was furnished by Mr. Willard, as was the Harvard Monument in the old Burying Ground in Charlestown and erected in 1828. The block was taken from the Bunker Hill ledge and cost about one-quarter of a cent per cubic foot.

He furnished at different times many designs for churches, hospitals, dwelling houses, stores, etc., and plans for remodelling churches and other edifices. In the fall of 1829 he was employed in reconnoitering the route of the Fitchburg Railroad. In December of the same year he drew outlines of several different routes, extending them as far as Brattleboro, Vermont. In 1831 he examined the route for a railroad from Boston to Taunton and Somerset. The same year he fulfilled a contract with Martin Brimmer of Boston and supplied the granite for the fence and gateway of the Granary Burying Ground, one block of which, that nearest the Tremont Building, is the largest in Boston, being about 35 feet long.

But had it not been for the miscalculation on the part of the quarrymen in cutting the stone for one of the pillars of the New York Exchange too large, the immense monolith would not now be resting in front of the famous old cemetery. When the stone was freed it was found to weigh over 110 tons, consequently a slab of more than 40 tons was cut from it and sent to Boston. Garrett Barry, one of the most skilful stone cutters of his time finished the block. Mr. Barry came to this country from Cork, Ireland, and for years was employed by Solomon Willard. He is said to have worked on the Ether Monument.

The work on the gateway of the Granary Burying Ground (the winged globe and inverted torches), and on the corner posts (winged glass), was cut at Quincy by Mr. Barry, and it is still among the best granite sculpture in the city.

The old Court House that stood on Court street was erected in 1836 by Solomon Willard. It was a gloomy Quincy granite structure, presenting a Doric front with ponderous columns of fluted granite, each 27 feet in height and four and a half feet in diameter, and weighs about 30 tons.

A similar portico in the rear towards City Hall was removed about 35 years ago in order to add to the length of the building. The form of the building was that of a parallelogram extending in length 176x54 feet. The height was 57 feet to the cornice, consisting of a basement and three stories. The structure was the least adapted to the comfort and convenience of courts, council and witnesses of any court house in the Commonwealth. It cost \$180,000.

These columns were among the heaviest, after those of the Branch Bank and Quincy Market, brought into the city. A team of 65 yoke of oxen and 12 horses was required to draw them, and the other monster monoliths from the railway in Quincy to Boston, a distance of over ten miles. While the mighty stones were being loaded by jack screws in the wagon the whole country for miles around had been scoured for oxen to haul it. Oxen were the more accessible beasts of burden in that section, as in all other rural districts, but twenty-six yoke could not be gotten together in a moment.

At a specified hour drivers each with a yoke of strong oxen, and men each driving two horses, gathered around the wagon. There were two chains fastened to the cart, and to each of these

two oxen were attached, making four abreast. The horses were hitched tandem fashion at the head of the possession, and each driver had his own yoke of oxen to look after.

Imagine such a team! What "geeing" and "hawing" there must have been to keep the lazy animals down to business and the whole in motion. When descending Milton hill and other steep inclines, the middle wheels were locked with chains, and more than one-half the number of oxen had to be hitched to the rear of the wagon to hold it back. The long calvalcade attracted much attention along the route, and when it reached the city it had undisputed possession of the streets through which it passed. One can imagine that those sixty-five yoke of oxen hitched together in one long-drawn-out line of swaying horns and switching tails must have presented an impassable barrier to any who desired to cross the street. The cost of transporting each column was \$100.

When the Court House was demolished in 1912 it was desired to save the portico and have it erected on an island in Boston Harbor. But it proved a more difficult task than originally planned. The gigantic columns had to be moved by the way of Court street, under which runs the East Boston tunnel, and across Scollay square on Washington street, thus being hemmed in by the tunnel, the Tremont street subway and the Washington street tube. Engineers were afraid the 30-ton pillars would cause considerable damage to those underground structures, consequently the pillars were split in three pieces.

In 1836, a contract was made by Mr. Willard with the New York Merchants' Exchange Company to furnish the stone for their new building, and the contract continued for over five years. Isaiah Rogers was the architect, and the company by Mr. Willard's suggestion, purchased the right to take the stone required from the Wigwam quarry from A. E. Belknap for five years. We presume that this was Mr. Rogers' transaction, as Mr. Willard enters the payment of the tax upon the quarry in this wise: "Paid Mr. Rogers' tax for ledge \$16, made out to A. E. Belknap."

John H. Stevens, president of the Exchange Company, visited the quarry in August, 1838, and expressed himself as follows respecting the work in progress: "I was pleased exceedingly with things there. I do not believe granite has been worked so extensively and beautifully in such masses since the times of the

Egyptians. The bases, consoles, flutings and caps are equally admirable."

Up to January, 1840, Mr. Willard had employed at the quarry from forty to ninety men, engaged exclusively in the work for this building, and he had received from the company and paid them \$255,794.91, while his salary was but \$5.00 per day. A very large amount of stone was required, including 18 fluted columns of over 30 tons each, and more than 50 other blocks of from 12 to 16 tons measurement. The finished columns were 32 feet 8 inches in height. After the first column had been successfully obtained Mr. Willard wrote: "I do not apprehend much difficulty in getting the whole out, although our neighbors in the stone business appear to be much concerned about it. I presume we can get them if anybody can, and at less than half the cost to them."

In July, 1840, he wrote: "We are now drilling a line of holes 84 feet long, and have a fair chance of getting two columns at the next split." On August 5th he wrote: "Our long split is wedged off about an inch, and I think will make what was intended. Our quarrymen have had to proceed with great caution on account of the great length." Another block was got out which it was expected would make four columns, but it was not successful. He wrote on July 8, 1841, during which time much of the granite for the Boston Exchange and Custom House had been got out and forwarded: "We expect to get through shortly, and to have the greatest hoorah and throwing up of caps that ever was in Quincy! We have saved three cartridges for the Yankee to be fired off when the last column is loaded."

Two years after most of the other work was done was required to finish up these columns. The cost of them is stated in an estimate of work remaining to be done in June, 1839, at \$1,500 each; but a later statement made in 1841, two of them upon which extra work was ordered are put down at \$4,000. "The prime cost of getting out one of these shafts is as much as the prime cost of a Doric column with its capital, for which \$5,200 is paid at the Custom House." The estimated work upon each was equal to four men for forty-five days. There was great risk in getting them out, and no less than five blocks which were split off failed to answer for a column, and one was rejected after it was rounded.

The work was completed in December, 1841, having been in progress five years and four months. During this time the com-

pany became greatly embarrassed. When the affairs were finally settled a considerable amount was found to be due Mr. Willard and his men, but all were finally paid, many receiving for their claims the new 5 per cent. bonds issued by the company. Although Mr. Willard remained unpaid to the last, he advanced out of his own pocket hundreds of dollars to the workmen to relieve them from pressing necessities.

In 1841, he furnished the granite for the Merchants' Exchange in Boston. The tall, plain and fluted pilasters that were in front of this building were much the largest in Boston and were raised into position by means of screws. The corner pilasters were 41 feet 8 inches in height, 6 feet wide and weighed about 55 tons. The emblem of commerce and navigation that formed the centrepiece in the front elevation, an engaged globe, showing parallels, meridians, and ecliptic, surmounted by the American Eagle, with cornucopias of productions, and coin resting upon bales below and projecting from behind the globe at the sides, a ship's mast, trident, anchor and caducens, although wrought by Garrett Barry, a stone cutter, nearly three-quarters of a century ago, is considered to be well done. This piece was removed when the old Exchange was demolished and embedded in the walls of the Chamber of Commerce.

Solomon Willard was employed in 1828 by the directors of Internal Improvements for the Commonwealth of Massachusetts to ascertain the cost, quality and quantity of granite for building the western railway between Boston and Providence. The stone was intended to be used for rails and bridges. The rails were to be long blocks of granite, about one foot square, resting upon a foundation wall extending to the depth of two and one-half feet below the surface of the ground and two feet wide at the bottom. The upper surface of the railstone was cut smooth to receive the iron rail, with a straight edge a little bevelled to the depth of one and one-half inches, on the inside, for the flange upon the wheel. They were closely fitted at the ends, and made of the same thickness for several inches from the joint. The iron plate rail was two inches wide, and three-eighths of an inch thick, with a perfectly flat surface. This was fastened upon the railstone by small bolts of tough iron, three inches long and three-eighths of an inch in diameter. Holes of these dimensions were drilled in the railstone, and the corresponding holes in the plate rail were countersunk to enable

the bolts to hold when cut even with the surface of the rail. The fastenings were about one foot apart along the rail. The road was gravelled between the rails, and about two feet on the outside, to the depth of six inches, which brought the surface of the gravel to within four inches of the top of the railstone. At the crossing of roads the gravel was brought to a level with the rails, and the back part of the railstone was raised a little above the iron rail, which was protected on the inside by a kind of edgestone, resting against the railstone and rising to the same height with it.

Mr. Willard examined a number of quarries along the line of the proposed road at one or two miles distance. Travelling westward he found considerable quantities of granite in Needham and Natick, but none which seemed to authorize much expectation of success until he reached the old Baptist Meeting House in Framingham, where they found an extensive ledge of good granite, to within twenty rods of the line. From that point westward they located abundant quarries of granite suitable for railstone at a distance of one to five miles upon the line and from twenty rods to two and one-half miles from the line until he reached Palmer. From that place he could not find suitable material until he arrived at Mount Tekoa, where a deposit of gneiss was found. From there on he found various ledges of granite on an average of about one mile of each other along the line.

In his report he says: "At the Bunker Hill ledge large quantities of granite have been split in large blocks of dimension stone, and delivered in the hammerer's shed, at 300 or 400 feet distance at 7 12-100 cents per cubic foot, for the last two years. The transportation of these stones was considered nearly half the labor. It is understood that many workmen are now employed at Quincy and Gloucester in quarrying edgestone and cellar stone, by contract, and by the day at two and one-half cents per cubic foot, they finding their own tools. These stones are generally considered as inexpensive to quarry, as would be the railstone, particularly as gouts and inequalities of one or two inches in the railstone would do no harm, and also at the various lengths from six to ten or twelve feet would lessen the labor. From all these circumstances I think five cents per foot would be a very safe estimate, for all risks of the quality of the ledges, which is the only exigency to be provided for in this item of expense. In estimating the cost of dressing and preparing the railstone for the work in accordance with the sample I have



RICHARD C. HARRISON,  
*Firm of Harrison Brothers, Boston, Mass.*



GEORGE W. B. HARRISON,  
*Firm of Harrison Brothers, Boston, Mass.*

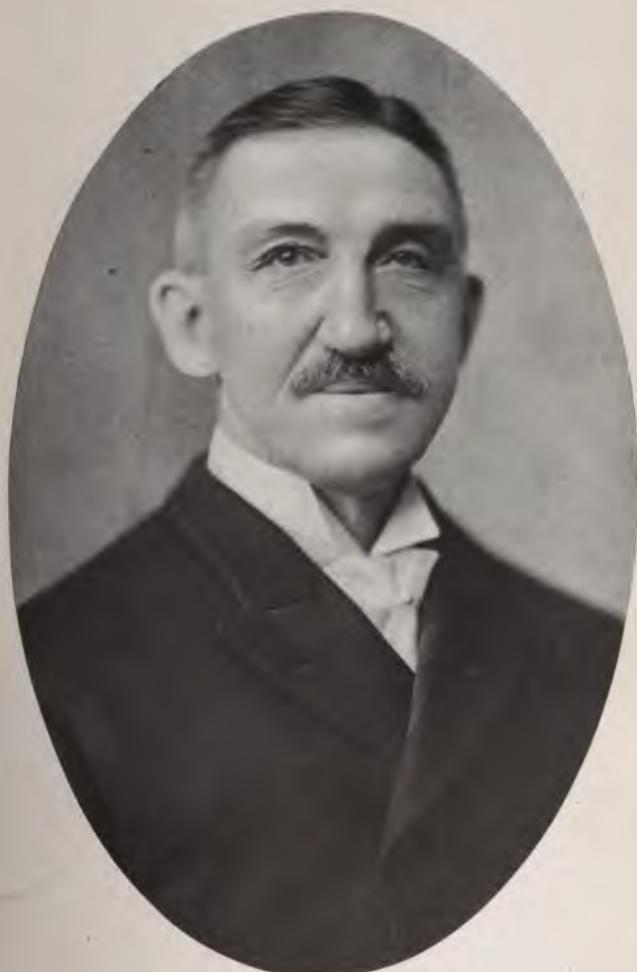


NATHAN C. HARRISON,  
*Firm of Harrison Brothers, Boston, Mass.*



"JOH" MONUMENT.

*Designed and furnished by Cook, Watkins & Co., out of Westerly Granite.  
Erected at Baltimore, Md., by F. J. Schaeffer.*



JOHN J. COOK,  
*Firm of Cook, Watkins & Co., Boston, Mass.*



BRADFORD C. PATCH,  
*Firm of Cook, Watkins & Co., Boston, Mass.*



PLANT OF THE COLUMBIA GRANITE WORKS, QUINCY, MASS.



ANGUS D. MARTIN,

*Firm of the Empire Polishing Co., Quincy, Mass.*



JOHN A. CLARK,

*Firm of the Empire Polishing Co., Quincy, Mass.*

compared it with the dressing of edgestone for sidewalks and other work of similar kind, and on this comparison I think forty feet would be but a reasonable day's work, and that four cents per foot in length would abundantly pay for the labor and tools. From inquiry I find that the price of a team of four oxen, cart and driver is \$2.50 per day, and that 10½ cents per ton for carting stone would cover the day's work. From these calculations the estimate would stand as follows:

|   |                  |
|---|------------------|
| For quarrying the railstone.....          | 5 cents per foot |
| Dressing and preparing them for work..... | 4 cents per foot |
| Hauling to line of road.....              | 4 cents per foot |
| Opening quarries and making roads.....    | 1 cent per foot" |

Mr. Willard lived in Quincy until his death, which occurred February 27, 1861, just as he was seating himself at the breakfast table. He was buried in Hall Cemetery near an immense pillar quarried for the New York Exchange, but which through some plan was rejected. Mr. Willard, with one or two assistants, erected this shaft several years before his death.

The Neponset river was used for navigation as early as 1820. Four years later a lumber wharf was built near the head of tide water, and in 1826 the Granite Railway Company ran a railroad from Quincy to the tide water at Gulliver's creek, bringing the granite from the quarries to the flat-bottomed barges at the creek in large cars. In 1827, William Hobart started his grain business near the head of tide water, and employed two schooners between New York and Dorchester, the cargo to Dorchester being grain, and to New York, granite.

In 1815 there was a great gale which destroyed the arch of the bridge over Neponset river. This arch was erected at the dividing line of the town in 1798, to commemorate the ratification of Jay's Treaty. The inscription on it, in letters of gold, read: "We unite in the defence of our country and its laws—1798. This bridge had been built by the towns of Dorchester and Milton in 1765, the former town building the two northern sluices, covering them with stone, and the latter town the southern sluices."

The rapid increase of the stone business had so multiplied and increased the inhabitants of West Quincy and East Milton that they demanded a more convenient and direct communication with Boston than the old bridge, and to relieve this urgent necessity the

General Court granted a charter for a new bridge over Neponset river, which was constructed in 1836, and called the Granite bridge, although built of wood.

The navigation of the river attained its maximum height in 1833, when seventy-four vessels, aggregating six thousand tons, unloaded their cargoes at Neponset village, at the head of navigation, besides many vessels which sailed up the river empty to be loaded with granite to be transported elsewhere. The navigation was practically ruined when the Granite bridge was erected.

There was a slate quarry at North Quincy. Samuel Rawson cut all the slate tombstones for the surrounding country, and as one old resident said: "My father owned a slate quarry there, and I remember well when a boy, seventy years ago (1880) frequently stopping on the way home from school to watch what was to me at that time a wonder, the chisel, when he was working out the weeping willows, death heads and wings, etc."

The following firms have been engaged in the granite business in Quincy: Newcomb & Richards, composed of Joseph Richards and Bryant Newcomb, 1803; William Packard, of the Parkard quarry, later worked by C. H. Hardwick & Co.; Granite Railway Company, Gridley Bryant, agent, succeeded by S. R. Johnson, George Penniman, J. B. Whicher and O. E. Sheldon, 1825; Bunker Hill Association, Solomon Willard, agent, 1827; Richards & Newcomb, composed of Joseph Richards and Jonathan Newcomb, South Common, 1827; Samuel Martin, 1827; Newcomb Brothers, composed of James Bryant, Jonathan and Samuel Newcomb, South Common, 1829; Thomas Hollis, 1828; Wright & Barker, composed of Henry Barker and Abel Wright, 1834 to 1842; Moses Day & Co. (Packard quarry), 1830; A. J. Mosier & Co., 1836; O. T. Rogers & Co., composed of O. T. Rogers, Jesse Bunton, Samuel Babcock and Noah Cummings, 1835; Barker, Wright & Co., 1842 to 1862; Richards, Munn & Co., composed of Joseph Richards, Luther Munn, Lysander Richards and John S. Lyons, 1829; Frederick & Field, composed of E. C. Sargent and Thomas Hollis, Jr., 1834; Henry Barker & Sons, 1866; Beal & Frederick, composed of Horace Beals and Eleazer Frederick, 1836; New York Exchange Company, Solomon Willard, agent, 1838; J. B. Whicher & Co., composed of J. B. Whicher, A. E. Sheldon, Jonathan Jameson and Samuel Ely, 1844; Newcomb & Chapin, composed of B. B. Newcomb and E. S. Chapin, 1847. Josiah Bemis, Joel Bemis, George Follette,

Thomas Drake, Greenleaf quarry; Ezra Beals, Gass quarry, later worked by John Q. Field; Samuel Martin, Thomas Hollis and Flanders, Rattlesnake quarry, later operated by O. T. Rogers & Co.; Moses Nightingale, Bass quarry, afterwards property of Frederick & Field; William Kidder also worked the Bass quarry; John L. Dutton, Gass quarry; Ezra Badger, near Mount Ararat, later worked by Churchill & Co.; Quincy Wild, Jonathan Williams, P. McDonald, Chester and Charles Mitchell, Dell & Bigamess, Badger Bros. and F. J. Fuller. Previous to 1872 several quarries were operated in West Common, notably the Bunker Hill quarry, but many were abandoned before that year, and later quite a number of quarries were opened by various firms and continued a few years, when they, too, were abandoned. The exceptions being the Merrymount Granite Company on North Common, Elcock & Sons on West Common, Bishop Brothers' Quarry Company, and the Blue Hill Quarry Company. Within a few years after 1872 the Quincy-Wild quarry passed to Field & Wild, who ran it until 1900, when they sold to the Quincy Blue Granite Quarry Company. Jonathan William's quarry soon passed into the hands of McKenzie & Patterson, who operated it until they sold out to the corporation known as the Quincy Quarry Company, who bought several quarries with the intention of operating them under one management. A few years later they sold that property to A. Falconer & Co. Frederick & Field did business until 1890, when the quarry was closed, but later it passed into the hands of the Quincy Quarry Company, who later sold it to John Fallon. P. McDonald's quarry was abandoned years ago. Henry Barker & Sons operated their quarry for years, but at the death of several of the firm it passed to Fagan & Ballow, and later to John C. Ballow, Mr. Fagan retiring. The Chester & Charles Mitchell firm was changed to Mitchell & Churchill, and after a few years Mr. Mitchell retired, and Mr. Hitchcock entered the firm, the firm name becoming Churchill & Hitchcock. Later the quarry was bought by the Quincy Quarry Company, and it was joined to the Dell quarry, both being operated as one. Badger Brothers still operate their quarry under the same name. Elcock & Sons' quarry is now operated by J. S. Swingle, who also operates the Berry Brothers' quarry. O. T. Rogers' quarry was sold to the Quincy Quarry Company, who now operate it. The Blue Hill Quarry Company was sold to the same firm and operated by them for a time, when they sold it to Falconer & Pierce and it is run by

them under the old name. Other firms are James Marks, 1831; John O'Neal, 1876; Kennedy & Mahan, 1878; S. Dell, 1875; Lee E. Faxon, 1862; E. De Gruny, 1879; C. Dunn, 1879; E. Baker, 1879; Lewis Dell, 1857; Hecter Murray, 1840; H. Farnum, 1878; William Moore, 1874; James Garrity, 1868; Wendell & Co., 1820; William Trantor, 1850; Charles Johnson, 1845; E. Roberts & Co., 1838; James Berry, 1850; Walter Berry, 1827; Charles Wilson, 1852. The only firm still cutting granite that was in the business in 1872 are McGrath Brothers, John Thompson & Sons, and Granite Railway Company. Badger Brothers are still in the polishing business.

The following industrial statistics of Quincy are given in Dr. Pattee's History: 1837—Granite quarried 64,590 tons, value \$248,737; hands employed, 533. 1845—The number of tons of stone is not given, but the value of the manufactured stone was \$324,500, and the number of employees 526. Ten years later the cash value of the stone had decreased to \$238,000, but the number of employees were but two less. In 1865, the ten quarries manufactured \$271,880 worth of stone on an invested capital of \$133,600. That year 306 hands were engaged. There is also mentioned that there was one establishment engaged in the manufacture of marble and grave-stones, who, with a capital of \$200, and five employees manufactured \$4,500 worth of these articles, using \$1,500 worth of stone. For the year 1875 is recorded the fact that there were twelve stone-cutting establishments, having an aggregate capital of \$50,000, and an output valued at \$156,600. These figures show that the business has fallen off since 1845. There was one shed in Randolph that produced \$20,000 worth of dressed granite on a capital of \$8,000.

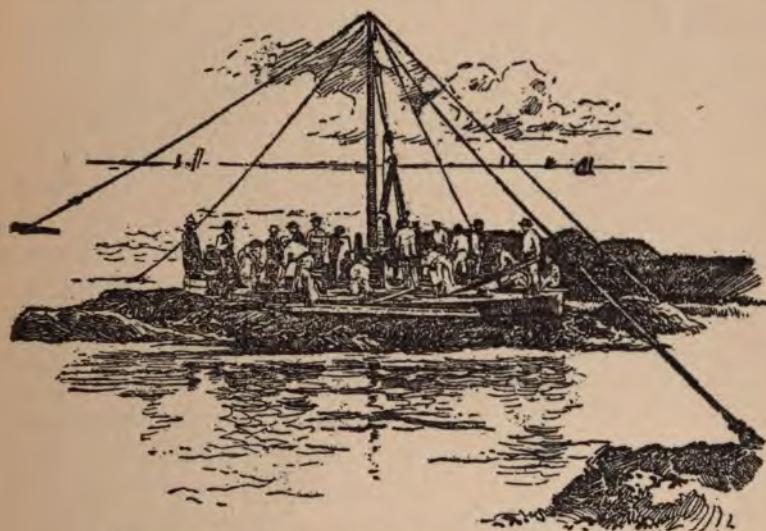
Minot's Ledge Lighthouse, Boston Harbor, marks the place that tells of man's defeat in the battle with nature in her strongholds, but it also tells of labor bravely performed under difficulties in the solution of one of the most knotty problems ever presented to the lighthouse service, and a victory for man through the courage, perseverance and ingenuity of Lieutenant-Colonel B. S. Alexander (brevet brigadier-general, U. S. A.), its constructor.

The tower is the granite record of an engineering feat of which the whole world cannot show the superior, and which stands peerless and alone in the new world.

The problem presented by this light was such that a beginning could only be made by a triple combination of favorable circum-

stances—a perfectly smooth sea, a dead calm, and low spring tides. Nothing but a small sailboat could be used with perfect safety, and when the huge two-ton stones were to be placed in position the boat carrying them to the rock could be brought up but in one place, and in a small sea it would pound on the ledge at the side, though the boat itself was in thirty fathoms of water.

Immediately after the formation of the present Lighthouse Board in 1852 it was determined to replace the former light on this



LAVING THE FOUNDATION FOR THE LIGHTHOUSE  
IN MINOT'S LEDGE.

ledge that was destroyed by a gale in 1851, by a stone tower. So a careful survey of the rock was made by Major Ogden of the Corps of Engineers, acting under orders of the Board. The survey showed that the top of the highest point of the rock was 3 feet 6 inches above the plane of low water; it also showed that it would not be possible to obtain a tower of a greater diameter than 22 feet without going outside the line of low water. This diameter was not considered sufficient either for stability or accommodation. But it was also shown that by going outside of and below the low water line in five places it might be possible to obtain a tower foundation of 30 feet in diameter. But try as he could not another inch could be added. In some places, especially these four shown in the cut



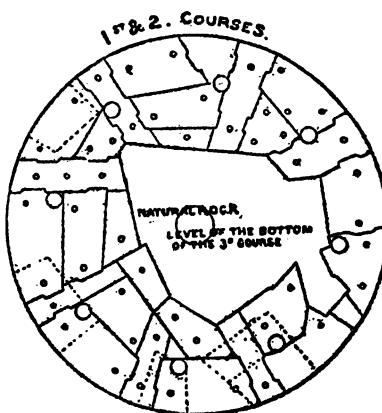
to the duty of construction. He first visited the vicinity of the ledge on May 1, 1855. The weather was fine, and he hoped to be able to land on the rock the next day, but on the following morning he found an old swell running which prevented any boat from approaching the rock. This swell continued until May 12, when he landed on the ledge for the first time.

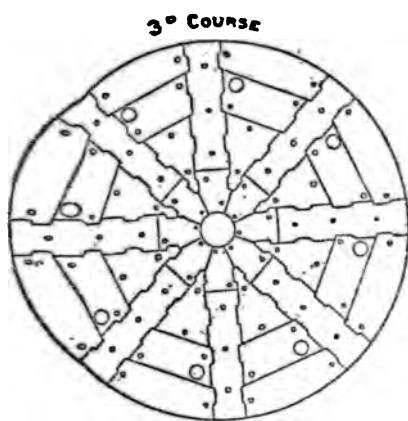
His first problem was to cut down the rock into a shape suitable to receive the foundation stone of the tower. He could not land even in the summer seas for weeks together at times, and when landed a part of the ledge was at all times under water and the remainder only bare for one or two hours at low water of spring tides. The space was contracted and the sea broke with such force that no cofferdam was possible. He asked himself how he was to begin, what should be the process, where were the workmen to live, and what were they to do while waiting an opportunity to land on the ledge.

He could foresee that cutting the rock into shape to receive the foundation stones would prove to be a very tedious, troublesome and expensive operation and one requiring incess-

of the foundation plan, where the circumference is flush with the outer edge of the rock, the ledge went down almost perpendicularly to a distance of from 10 to 40 feet.

The survey was placed in the hands of General Totten, then chief engineer of the U. S. Army, and a member of the Lighthouse Board, who took upon himself the duty of planning a masonry tower for the position. In April, 1855, Lieutenant Alexander was assigned





sant vigilance. He knew that when he was unable to land he must do so with a large party of skilled workmen with all the necessary tools and implements. He determined, therefore, to combine the operation of cutting down the rock for the foundation with the cutting of the granite for the tower, and have both done by the same party of workmen to whom constant employment and full wages could be given.

To accomplish this it was necessary to have a shore establishment as near the lighthouse site as possible, with wharf accommodations, storerooms, workshops, with a yard where the stone could be cut and fitted together preparatory to being moved to the ledge. By providing the necessary vessels and boats a gang of stone cutters could then work on the ledge when sea, weather and tide would permit, and when they could not there would be full employment on shore for cutting the stone for the tower.

It was determined to erect a permanent scaffold on the ledge, not a beacon house, but a structure of iron, to which the workmen could be secured, to protect them from being washed from the rock, and to afford means of temporary security in case of accident to the boats or vessels. It was also to answer the purposes of a derrick for laying the lower courses of masonry in the tower, the lighthouse being built around the piles of this scaffold they would be so many huge bolts to secure it to the foundation of the rock.

On June 20, 1855, the men began to loosen the wedges around the stumps of the old iron piles, and remove the mossels from the top of the ledge. The real beginning was made at daylight, Sunday morning, July 1, 1855. The morning was beautiful, clear and calm, and just as the sun was rising above the horizon, Lieutenant Alexander took a hammer and chisel, called the party together and after a few remarks struck the first blow in a long battle between man and the forces of nature.

He began by cutting for a trench level on the highest point of the rock. This trench level was the point from which all levels

were to be taken while cutting down the foundation. As the whole of the top of the rock down to a plain 1 foot 9 inches below this trench level was to be removed, they began on that day and continued for several days to mark points of intersection of this plane with the surface of the rock, cutting thereby a level space around the rock upon which the workmen could stand, and upon which tools could be placed with comparative safety.

In 1855 there were 130 hours' work done upon the rock.

April 1, 1856, saw the opening of the second season's work. One of the greatest difficulties in preparing the foundation was in cutting the vertical surfaces of the rock so as to receive the vertical points of the foundation stones. The level surfaces could be more easily prepared, because the rock would be plugged off and the service be brought to a plane even where there was a depth of two or three feet of water over the space of the cut. There were to be two partial courses of stone in the foundation before the first full course of masonry. The form of every stone in this foundation had been worked out by General Totten, but owing to blind seams in the rock and to an accident, the number and sizes of the stones had to be altered. As finally finished there are seven stones in the lowest or partial course, all having the level of their bottom bed below the water, these levels of bottom beds varying in depth from seven inches to two feet two inches below low-water level, the last depth being the level of the bottom bed of the lowest stone in the structure. There are twenty-nine stones in the second partial course; of these twelve have their beds below water.

The following is an outline of the manner of cutting the nautical surfaces around the outside of the tower and along the inside lines to which the rock was shaped to receive the stones of the lowest course fitted into it. The men were provided with inch and a quarter drills from two to four feet long, and having marked the ends of a line upon which a vertical surface was to be cut, they would start at low water, as many holes as possible, about one inch apart, carrying these holes down, at first to a depth of only one or two inches. During a good tide three men, one to hold the drill, and two to strike would start from twenty to thirty holes. When a line was thus marked these holes became guides into which longer drills of the same size could be inserted without danger of making mistakes, even when there was two or three feet of water on the rock. These holes were then drilled down to the exact depth

**required.** The space between these holes was then "set out," that is to say, the stone between the holes was crushed out by a set like that used by stone cutters in "setting out" Lewis holes. This set was a piece of octagonal steel, like an ordinary drill, but made so as to be about seven-eighths of an inch by one and one-half inches on the bottom, so as to cover the space between two adjacent holes. Having placed this tool in its proper place, it being too large to enter the holes made by the drills it was driven to the bottom of the holes with the ordinary striking hammer.

These holes and this setting out process having been carried to the required depth all the way around any particular portion of the ledge to be removed, disconnected that portion from the rocks to which it had been joined. It was then easily removed without danger of injuring the adjacent posts. This drilling and setting out process was carried along all the interior lines of vertical cutting as well as around the outside of circumference of the foundation pit, the centre of the holes in the latter case being placed as nearly as possible on the circumference of the base of the tower, or 15 feet from its centre. So when the circle was set out and trimmed up the foundation pit was about one-half an inch larger all around than the first complete course of stone in the tower, or, in other words, the radius of the foundation pit was 15 feet and half an inch.

A permanent cofferdam was out of the question, but the lieutenant formed temporary cofferdams around small portions of the rock with sandbags like those used in building a sandbag battery. The duck was heavy and, therefore, practically water tight, and being about half full of sand was easily handled. Two or three hundred of these bags built up at low water around a small portion of the foundation pit which it was desired to finish, or where it was wanted to lay a stone in mortar would keep out the water for fully half an hour if the sea was very smooth.

During the month of June, 1856, an iron scaffold was erected on the rock. It consisted of nine iron shafts inserted into the holes of the old iron lighthouse and rising to a height of 20 feet above low water. The whole was bound together at the top by a strong wrought iron frame. The posts were 60 inches in diameter at the rock and 7 inches in diameter at the frame. This scaffold gave the workmen some command of the rock, and it gave great confidence to the new hands. By stretching lines between

the posts across the rock in different directions about two or three feet above it, every workman had something within his reach to take hold of when a wave broke over the rock, thus doing away with the constant apprehension of danger.

In 1856, 157 hours' work was done. On the 19th of January, 1857, the bark, "New Empire," was thrown against the scaffold during a gale and swept it from the rock, breaking off the iron posts so as to shatter the top of the rock in places, so that a portion of the work had to be done over again. The year 1857 was very unfavorable for work, only 130 hours being done. But the foundation pit was nearly completed, and four courses of the foundation were laid.

The season of 1858 was much more favorable. The foundation pit was finished and the masonry of the tower carried up to the sixth course, inclusive. The lowest stone was laid July 11, 1858. This stone and six others had to be laid in the water. The method adopted for securing a bed of mortar under these stones and also in their vertical joints was as follows: A large piece of thin muslin was spread on a platform on the ledge. A layer of mortar was then spread over it of the required thickness. The stone was then laid on this bed of mortar. The vertical joints of the stone were then plastered with mortar. The cloth was folded up and laid smooth along these vertical joints, having its superfluous parts cut away. After remaining five or ten minutes the mortar would begin to set so that it and the attached cloth would adhere to the stone. The stone was laid in this envelope, which protected the mortar from the dissolving action of the water while it was being lowered into position. The mortar oozed through the cloth, so as to form a good bind to the stone below.

This year 208 hours' work was done, and in 1859, the masonry of the tower was carried to the top of the 32d course, 62 feet above low water; working time 377 hours. It was completed on June 29, 1860, and the light exhibited for the first time November 15, 1860.

The masonry is so locked and dovetailed together that the impact of each wave only makes it so much the stronger, and no stone could be shaken from the outside without first pushing the two sides further out, and that would only hold the rest all the firmer.

Those little angles and corners in the course are three inches

in length, and each course is two feet thick. Each stone weighs two tons on the average, and besides being locked to its neighbors it is bolted in two places to its upper and lower fellows by a pair of two-inch galvanized wrought iron bolts; and the foundation stones were secured to the ledge by similar bolts which entered the ledge to the depth of a foot. In addition, eight 10-inch wrought iron piles were inserted in holes in the ledge to the depth of four feet, and they ran up into the solid portion of the structure some 20 feet.

No time was lost in building the light house nor was anyone seriously injured.

## CHAPTER IV.

MACHINERY AN IMPORTANT FACTOR IN THE DEVELOPMENT OF THE  
BUSINESS.—METHOD OF QUARRYING.—TERMS USED  
BY QUARRYMEN.

THE various great improvements in the methods of quarrying Quincy syenite must be noted. At first, the rude primitive manner was to heat the stone, and let fall upon it a large iron ball to split it. Another system was to excavate a deep cavity in the ground under the large boulders, and fill the excavated space with brush or some other combustible matter, and set fire to it. When the stone became sufficiently heated, it was broken in various parts by the use of heavy sledge hammers. Then came the process of blasting, by drilling single holes in the stone, which was in use until the Louis hole was proven better.

The introduction of pneumatic tools and machinery has rendered possible the utilization of the granites in monumental work to an extent that was quite impossible when the stone was dressed by hand.

Polishing granite by machinery was first introduced into this country at Quincy in 1869. Some attempts had been made previously, but the machinery made was crude and little success was obtained. In 1869, three Scotchmen, Gordon McKenzie, John Westland and George S. Patterson, stonemasons located in Quincy, formed a co-partnership under the firm name of McKenzie, Westland & Patterson. They hired land at the Quincy canal and built two straight sheds with an overhead travelling derrick between. One shed was used for cutting and the other for polishing. The plant consisted of a 30 horse-power engine and boiler, a travelling carriage, two vertical and two pendulums.

Mr. Westland had considerable knowledge of polishing, having been in business for himself for several years in Aberdeen, Scotland. He died in 1872, and the firm name was changed to McKenzie & Patterson. They carried on an extensive business in cutting and polishing granite until the death of Mr. McKenzie in 1897. Shortly thereafter, Mr. Patterson gave up manufacturing and the plant was sold and demolished.

When they first commenced polishing the price for plain work was \$3.50 per square foot, and \$3.00 to \$4.00 per lineal foot per member for mouldings. The material used was beach sand for grinding, and Turkish emery for closing up the stone. All cutting for polishing had to be straight 8-cut work. The process was a slow one and the company endeavored to keep it a secret, allowing only their employees inside the polishing mill. However, these restrictions were unsuccessful, for about 1872 or 1873, Messrs. Churchill & Hitchcock built a small polishing mill in connection with their cutting shed, on the North Common, and put in two small verticles. The price for plain polishing was then lowered to \$2.75 per square foot. This reduction in cost stimulated the business and for the next decade the amount of polished work increased rapidly, so that a number of firms engaged in the business, among them Henry Barker & Sons, McDonnell & Sons, Frederick & Field, Murdock & Smith, Milne & Chalmers, and Badger Brothers.

With the increase in the number of firms engaged in polishing, prices dropped to one dollar per foot, and later there was a further drop to sixty-five cents per foot.

About that time an improved polishing machine was put on the market by Wright & Sons of Montpelier. Chilled iron shot was also introduced to the trade, but the inventor placed such annoying restrictions upon its use, and almost a prohibitive cost (above 12 cents per pound) upon the article that when a few months later Mr. Harrison of Canada offered chilled iron for less than half the price of the American article, almost every firm in the business began using the Canadian product, but soon found that they were liable for damages for infringement of the American patent. The owners of the patent settled most of their claims by long-time notes, and as the life of the patent expired only a few of the notes were paid.

Up to and including thirty-seven years ago, the only abrasive used for sawing or polishing stone was sea sand. This was used with the old-fashioned gravity gang, a one saw frame, swinging like a pendulum, with ropes over the top of the frame on small pulleys, and at the end of the ropes heavy pieces of iron or stone, which would allow the saw frame to rest on the stone with sufficient pressure to enable the saw blades to force the sand through the stone at a moderate speed, the sand acting as teeth for the blade as the blade came in contact with the stone.

About thirty-seven years ago, John Harrison, a government

contractor, father of the firm of Harrison Brothers, conceived the idea of using iron filings in place of sand, with the result that he found it was possible to increase the sawing output to such proportions that would warrant the use of an artificial abrasive in place of sand. Later it was found that with the old style gravity gang saw it was impossible for it to go through the stone as fast as the abrasive would allow it. This, in turn, lead to the discovery of spiral gears for sawing frames, which forced the saw through the stone at any speed desired by the operator.

After several years of careful experiment, a cast iron shot came into existence, and was patented by John Harrison, the material being made solely for his own use and in his own stone mills. It was not long, however, before the public learned of the fact that there was an artificial abrasive that was sawing more than twenty times faster than stone had ever been sawed. Orders came from all directions for this material, and it finally became necessary to establish a plant to produce shot only. In looking around for the cheapest metal market to be found, it was decided to locate the first large plant at Middlesbrough, England, where it was possible to get the raw material direct from the earth and produce shot at a minimum cost. This plant was established in 1887, the first of its kind in the world.

In manufacturing cast iron shot it was found that by making special sizes for sawing each kind of stone better results could be obtained. The stone sawing machinery kept pace with that of shot. After many years it was found possible to produce a chilled steel shot which has been called by the manufacturers Harrison Brothers' New Process Steel Shot. This material is shipped to all parts of the earth where stone of any kind is worked, and it has revolutionized the sawing and polishing of granite. Further experiments lead to the manufacture of what is known as Diamond Grit, or broken New Process Steel Shot, which is angular in form. This is used for sawing soft stones, such as sandstone, limestone and for grinding down the face of terra cotta, brick, glass, onyx, etc.

The Harrison Brothers have a plant covering an area of one and one-quarter acres, producing New Process Steel Shot and Diamond Grit, and they give employment to a large number of men. Being specialized in this particular line of business and being the original manufacturers, they are producing an article that is recognized as of a superior quality and which is doing 35 per cent. more work than any other abrasive of its kind manufactured.

Henry Parker & Sons of Cape Ann, in 1877, had built in their stone works a sawing machine which was the first in the United States in constant use established for sawing granite with iron globules.

The modern polishing plants are a great improvement over their predecessors. Powerful overhead traveling cranes, large, heavy machines that use rings weighing from 800 to 900 pounds, and with a capacity of more than 25 feet per day are used, while small but effective machines for small work are also employed. In the old days six to eight square feet of polishing for a machine was considered a good day's work, and workmen were paid about 22 cents the hour. Today thousands of square feet of stone are polished daily, and the workmen receive forty cents per hour. Then all stones for polishing had to be well bushed, not less than 6-cut, but now rough pointed work only is required. It is also a notable fact that while the use of sand and emery has been entirely discontinued, yet nothing has been found that will take the place of putty powder or pulverized zinc and felt for glossing or finishing the stone. Very little improvement has been made in polishing mouldings by power. The pendulum is the same as of old, and the price high, about one dollar per lineal foot per member. Very little moulded work is polished and what little is treated is usually done by hand.

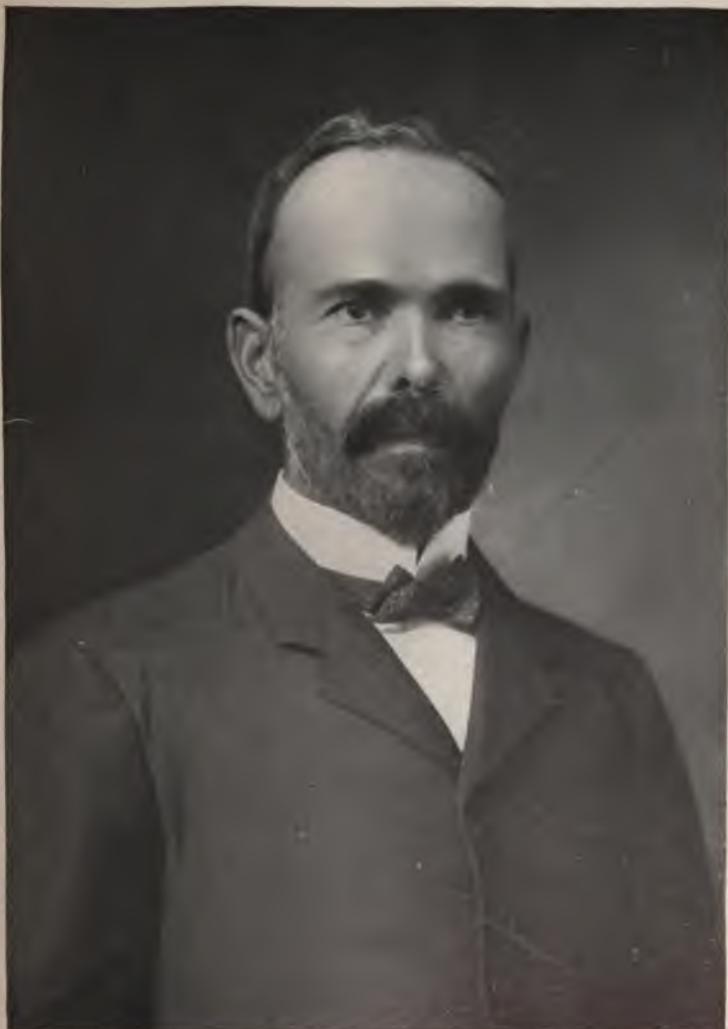
This custom of polishing granite is a revival or restoration of the Egyptian system of embellishing their syenite which is as old as the everlasting pyramids. The improvements in this branch by machinery has so reduced the cost as to make polished work more common than formerly. The polished surface is much more beautiful; it is also, so it is claimed, more durable, as the surface is thereby rendered perfectly impenetrable to the disintegrating elements, and the ravages of time, as may be seen in the beautiful specimens of polished red syenite of ancient Egypt, which still retain the original polish and color unimpaired.

Mr. Joseph Richards, of the firm of Richards & Munn, invented in 1831 the bush or axe hammer. The name of bush hammer was evidently local, as at Philadelphia and some other places, it was called axe hammer, from the several little axes being keyed into the cheeks of the instrument. There are six, eight, ten, or more axes connected with it. The number used depends upon the fineness the artisan desires to dress the stone. This useful instrument was first made by Richards, solid or wholly in one piece, for which he received a patent. Since then improvements have been made by

constructing it in several pieces. Mr. Richards is also said to have been the first to suggest, construct and utilize the Louis hole, as now applied for blasting purposes. A machine for dressing stone, patented by Charles Wilson of New York was set up in Quincy in 1853 by Richards, Munn & Co. Not proving a success it was removed to the Rockport quarries on Cape Ann, where it was used only one season by Barker, Wright & Co. with more or less success. The same system is said to have been in use in Aberdeen, Scotland. The McDonald stone planing and bushing machine was patented and manufactured by the McDonald Stone Planing Machine Company of Boston in 1879. This machine will plane 7 feet 6 inches wide, but a stone 10 feet 6 inches in width can be run through on the carriage, the carriage traveling when planing a stone 7 feet 6 inches wide at the rate of 3 inches per minute or 15 feet per hour, but can be run when not planing at the fast speed of 30 feet per minute. The average speed of the planer is 25 revolutions per minute. The planer will take off a chip one inch deep, planing the surface the full width of the machine 7 feet 6 inches, and with the carriage traveling at the rate of 15 feet per hour, planing a surface of more than 100 square feet of stone per hour. The bushing machine which is attached to frame and runs directly behind the planer can be used when bushing is required.

The old method of drilling and blasting formerly applied to all classes of rocks, is now done away with, excepting in the very hardest and toughest of materials, or where, as in the case of the trappean rocks, the material is to be utilized only for road material. Even when drilling or blasting is resorted to, it is the custom to drill a series of holes in the line along which it is desired the stone shall break; these holes are then charged lightly and fired simultaneously. In this way the force of the explosion is delivered along a considerable surface, and the danger of shattering the material through the sudden jar is reduced to a minimum. This process is largely limited to granitic rocks which are too hard to be quarried by means of the channeling machines.

The drill commonly employed for this work consists in its simplest form of a steam cylinder mounted upon a tripod, with the drill attached directly to the piston. Since a flexible hose is used to convey steam from the boiler, this form of drill can be carried to any part of the quarry. Numerous adaptations of this drill have been put upon the market by various makers on soft stone, like sand-



JOHN L. MILLER, QUINCY, MASS.



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MR. AND MRS. WILLIAM H. BISHOP AND THEIR FAMILY,  
QUINCY, MASS.



JOHN S. ANDERSON,

*Firm of J. O. Golbranson & Co, Quincy, Mass.*



JOHN O. GOLBRANSON,

stone or granitic rocks, with a well-developed rift and grain. Drills of this kind are utilized in what is known as plug-and-feather splitting. Here a series of holes of a diameter and depth depending upon the character of the rock are drilled at intervals along the line at which it is desired to break the stone. Long metal wedges or plugs are then driven into the holes and the material is split away in fairly regular blocks.

Channeling machines are utilized in the softer rocks since they would be liable to injury through blasting. One of the earliest of these machines upon the market was the Wardwell channeling machine, but the later improvements make it possible to cut a channel at any desired angle. What is known as the quarry bar, answering the same purpose as the channeling machine, is also used. A machine based on the same principal for undercutting or gadding, is in common use in marble quarries. A diamond drill machine is used for similar purposes.

After the stone is removed from the quarry bed it is worked into the desired shape and size by a process dependent largely upon the stone. Formerly a block after being reduced to an approximately rectangular form by means of hand plug-and-feather splitting, was still further reduced by pitching tools, followed when necessary by such implements as the point, axe, pean hammer and bush hammer. But pneumatic tools have almost entirely replaced hand and steam implements. The pneumatic surface machine is used by every stone-cutting shed and quarry as are other tools, such as cutters, drills, etc. Lathes and planers are also extensively used; indeed, the production of cylindrical columns by the old hand method has been entirely superseded by lathes similar to those used in turning metals. A circular planer is used for working out curved surfaces. In handling the material in the yards and shops, traveling cranes and derricks are used much as in iron and steel works.

At Barre, whenever the sheets are imperfectly developed the following method of using explosives is adopted: A thick rectangular block is obtained by channeling along a vertical rift, and also at two points along the hard way, at right angles to the rift, the fourth side being that of a joint or heading. An artificial sheet parting is then made by drilling divergent holes 10 feet deep along a horizontal grain. These holes taper from one and one-half inches to one inch and are filled with but small charges of powder.

Quarrymen, like other artisans, have their own peculiar terms

to denote the character of their work or to explain the method they use. Among the more familiar of these expressions are the following:

BLACK HORSE—A dark biotite gneiss in contact with the granite.

BLIND SEAMS—Incipient joints.

BOULDER QUARRY—One in which the joints are either so close or so irregular that no very large blocks of stone can be quarried.

CHANNEL—A narrow artificial incision across a mass of rock, which, in the case of a granite sheet, is made either by a series of continuous drill holes or by blasting a series of holes arranged in zigzag order.

CLEAVAGE—A structure consequent upon the geometrical arrangement of its molecules at the time of its crystallization.

CLOSE-JOINTED—Joints that are very near together.

CUT-OFF—The direction along which the granite must be channeled because it will not split.

DIMENSION STONE—Stones that are quarried of required dimensions.

GRAIN in granite is practically the direction in which the stone splits "next easiest," the "rift" being that in which it splits most readily.

GROUT—Waste material of all sizes obtained in quarrying stone.

GROW-ON—The place where the sheet structure dies out, or the place where two sheets appear to grow onto one another.

HARD-WAY—The direction at right angles to both rift and grain in which granite does not split readily.

HEADING—A collection of close joints.

KNOTS—Dark gray or black objects, more or less oval or circular in cross-section, which are segregations of black mica or hornblende formed in the granite while in a molten state. English quarrymen call them "heathen."

KNOX HOLE—A circular drill hole with two opposite vertical grooves which direct the explosive power of the blast.

LEWIS HOLE—An opening made by drilling two or three holes near together and chiseling out the intervening rock.

RANDOM STONE—Quarried blocks of any dimensions.

RIFT—An obscure microscopic cleavage in granite which greatly facilitates quarrying.

**RUN**—A term used by quarrymen in connection with "rift," apparently to denote the course of the deflection of the rift due to gravity, strain, or other not yet understood cause.

**SALT-HORSE**—Quarrymen's term for aplite.

**SAND SEAMS**—More or less minute veins or dikes of muscovite (white mica) with some quartz, in cases also with feldspar.

**SAP**—Ferruginous discoloration along sheet or joint surfaces.

**SEAM**—Quarrymen's term for joint.

**SHAKES**—A somewhat minute close-joint structure, which forms along the sheet surface as a result of weathering (?).

**SHEET QUARRY**—A quarry in which the granite lies in sheets, crossed by wide-spaced steep joints.

**STRAIN-SHEET**—Granite sheets produced by present compressive strain.

**STRIKE**—The direction at right angles to the inclination of a plane of bedding, a sheet, or joint, etc.

**STRIPPING**—The material (sand, clay, soil, etc.) overlying a rock of economic value, which must be removed before quarrying.

**SPECIFIC GRAVITY**—The weight of a rock or mineral compared to that of a body of distilled water of the same bulk.

**TIGHTSET**—Equivalent to blind seam, an incipient joint, in places associated with microscopic quartz veins.

**TOEING-IN**—The wedging in of the end of a granite sheet under an overhanging joint, probably in consequence of the faulting of the sheets along the joint. It is also applied to the overlapping of lenticular sheets.

**"TOE NAILS"**—Curved joints intersecting the sheet structure in most cases striking with the sheets, in some differing from them in strike 45 degrees or more.

**WEATHERING**—The decomposition of a rock owing to the action of the weather.

## CHAPTER V.

QUINCY GRANITE A TRUE SYENITE.—SOME OF THE QUARRIES  
PRODUCING AND THE FIRMS MANUFACTURING  
THIS STONE.

Q UINCY granite is a riebeckite-aegirite granite, riebeckite and aegirite being varieties of hornblende and augite, respectively. The general color of the fresh normal granite ranges from a medium gray or bluish gray to a very dark bluish gray, all with black or blue-black spots. Its texture is medium to coarse and even grained, with feldspars up to 0.4 and 0.5 inch, and the black silicates up to 0.3 and 0.4 inch. Its constituents are: (1) A medium to dark bluish gray feldspar always with minutely intergrown soda-lime feldspar. It is apparently more or less darkened by a varying number of extremely minute particles of a black mineral. (2) Medium to dark smoky quartz, some of it with a slight bluish tinge. This quartz also incloses minute black particles, and in places hairlike crystals, presumably of rutile. (3) A little lime-soda feldspar. (4) Riebeckite or hornblende and aegirite or augite, both minerals being in many specimens intergrown.

Quincy granite for monumental purposes goes under the names of "medium," "dark" and "extra dark." The estimated mineral percentages show that these differences in shade are due in part to a variation in the amounts of the black silicates and of the smoky quartz. In part, they are also due to a variation in the degree of kaolinization of the feldspars and in the abundance of black particles and of hornblende in them. The smokiness of the quartz appears to be due to infinitesimal particles of some black mineral. The bluish tint of the feldspars is due to microscopic crystals of riebeckite. The contrast of shade is chiefly between the black silicates and the combined quartz and feldspar, except where the feldspar is whitened by kaolinization, which causes it to stand out from the quartz. Quincy granite is noted for its high polish. This susceptibility to high polish is due to the absence of mica and to the coarser cleavage of the varieties of hornblende and augite which take its place. The crushing test of Quincy granite is 17,000 pounds to the cubic inch.

Syenite, which is the character of stone quarried in Quincy, is composed of quartz, feldspar and hornblende. The difference between syenite and granite is that the former contains hornblende instead of mica. It received its name from the city of Syene, Upper Egypt, where large quarries of it can be found of a pinkish hue, but more recent investigations have proven that the ancient syenite is only granite with black mica, and not hornblende, as was supposed.

Dark or extra dark Quincy granite needs no "doping" or coloring. The practice of "doctoring" Quincy stone must be resorted to only when medium or light stock is substituted for dark, or in order to cover the plaster in defective polishing. But if stock, which is naturally dark, is sufficiently ironed down and polished, adulteration can add nothing to the intrinsic beauty of the pure granite. Of course, it should be borne in mind that the best stock and good polishing command a higher price than inferior stock and poor polishing; ink and lamp black are cheap. However, the difference in price is justified, because a polished, extra dark Quincy granite monument, properly finished, makes a memorial of unsurpassed beauty.

WE HAVE TOLD THE STORY of the first railway in the United States, and of Solomon Willard and his wonderful achievements in connection with building the Bunker Hill Monument, but the concluding chapter to date of the industry began by him remains to be narrated. There has been little, if any, interruption to the business during the 86 years of its existence. Of course, the original owners have died, to be succeeded by others, and they in turn by men of another generation, but it is only a change of management, the Granite Railway Company still goes on. The original railway in 1870 was merged into the Old Colony Railroad Company, and it passed into the control of the New York, New Haven & Hartford Railroad. But these changes have added to the facilities of the Granite Railway Company by the rail connections with their own five miles of track that reach every part of their quarry and yards; they thus are as well, if not better, equipped with shipping facilities than any quarry in New England. Added to these improvements they have installed in quarry and yard every known modern appliance and tool with which to facilitate the quarrying, cutting and handling of their stone. After the deal of Thomas H. Perkins, in 1854, much of their land extending on the west to East Milton was sold, and in 1900, the Park Commissioners of the Commonwealth took the

wharf at Neponset, but they still retain an area sufficient for their large business.

The old Bunker Hill quarry has not been operated for years, but in its place another nearby, called the Pine Hill quarry, has been developed, and it is the largest and best dark blue quarry in Quincy, and the company claims that they are the only firm in Quincy that undertakes to handle the largest class of work in this grade of stone to the limit of transportation.

During this long business career they have furnished many monuments of note, one of which, that for the Hon. William C. Whitney, ex-Secretary of the Navy, is illustrated on another page of this history. This monument is cut from their dark granite and is all polished, and it is safe to say that no more beautiful specimen of the art can be produced. In addition to their monumental work they make a specialty of shipping Grout stone for grade crossing work, rip-rap, etc. The illustration herewith shows a trainload of this material on their railroad leaving their quarries, the aggregate weight being more than five hundred tons. Building work is another important part of their business. Some of the most noted structures in this country have been built of material furnished by them. Among which, beside the Bunker Hill monument and the equally famous Minot's Lighthouse at the entrance to Boston harbor, may be mentioned the United States dry dock at Charlestown, Mass., and Gasport (now Norfolk), Va., the Boston Custom House, New Orleans Custom House, the Old Tremont House, Boston, the Astor House, New York City, the Equitable Life Assurance Company's Building, New York, Charter Oak Life Insurance Building, and the Hartford Life Insurance Company's Building, Hartford, Conn., the Munroe County Court House, Rochester, N. Y., as well as many more modern public and commercial buildings in this country.

In 1864, the company bought a light quarry at Concord, New Hampshire, which they operated until 1901, when it was sold. They employ about 75 hands and their trade extends all over the United States, including Honolulu.

L. S. Anderson, the able treasurer and manager of the Granite Railway Company, is a native of Braintree, Massachusetts, but took up his residence in Quincy 43 years ago. He was graduated from the Boston English High School in 1873, after which he prepared for Harvard University at Adams Academy, Quincy. He was graduated from Harvard in 1882, and soon after was employed as clerk in the general freight department of the Old Colony Railroad Com-

pany for three years, when he was engaged as assistant to the president and assistant treasurer of the Union Pacific Railroad, where he remained six years. He then was appointed superintendent of the Quincy Quarry Railroad Branch, which position he held until 1900, when he assumed his present duties.

HENRY C. SMALLEY, president of the Henry C. Smalley Granite Company, Inc., 74 to 88 Penn street, Quincy Adams, is a native of Shrewsbury, Rutland County, Vermont, where he was born February 14, 1862. After completing his education at Vermont Academy, he entered the employ of the Vermont Marble Company, Proctor, Vt., for about a year, and was then transferred to the Boston Branch, and after about a year in the office and yard, he was employed as their travelling salesman for New England and Maritime Provinces for about five years. He then was the travelling representative of Torry & Co., Boston, for nine years, after which time he took up the granite business, first as a jobber, and soon branched out as quarry owner and manufacturer. He owns the Calder and Carnie Westerly Granite Company, Westerly, R. I., which company has in operation two quarries, one producing the famous Calder & Carnie Pink Westerly, acknowledged to be the best Pink Westerly in the market, and the other quarry producing the Red Westerly, which is recognized as one of the best Red Granite Quarries in operation. Aside from these two quarries he owns the Daniels Granite Company, Milford, N. H., which produces the Souhegan Blue and Souhegan Dark granite, which stock is fast gaining favor wherever it is used.

This company has furnished some of the best work produced, one job being the "Roth" monument, of extra dark Quincy granite, which sets at West Elizabeth, N. J., also the "Griffith," of Blue Gray Westerly, in Wareham, Mass., and many other ranging in price from \$500 to \$5,000. The company has one of the best, if not the best, equipped cutting plant in Quincy and probably employs more men than any other firm.

Andrew McIntosh, Jr., vice-president and manager of the Henry C. Smalley Granite Company, was born in Aberdeen, Scotland, January 1, 1868. He came to this country when five years of age, and after leaving school he served his time as granite cutter and carver in Quincy and Westerly. His wide experience has equipped him to maintain a high standard of work such as this firm has the reputation of producing.

THE FIRM OF BIRNIE & DIACK, Columbia street, Quincy Adams, is composed of William L. Birnie and Alfred O. Diack. Both men are natives of Aberdeenshire, Scotland, the former being born March 22, 1855, and the latter October 31, 1867. Mr. Birnie learned his trade in the quarries of Kemnay, Scotland, and at Aberdeen, where he worked nine years. He then came to this country and was employed by General Tilson at Hurricane Island, Me., where he remained one year, going from there to the Bodwell Granite Company, Vinal Haven, Me. Three years later he went to Milford, Mass., and from there to Graniteville, Mo., where after a few months he returned to Milford, and in 1890 went to Quincy in the employ of W. C. Townsend, and later for S. Henry Barnicoat, when he became associated with Mr. Diack.

Mr. Diack learned his trade in Kemnay under his father, Alexander Diack, after which he worked as journeyman in Jersey Island, and in Wales, when in 1889, he went to Milford. Two years later he went West, working in Texas, Colorado and California, when he went to Quincy and worked for S. Henry Barnicoat and later with McIntosh & Son a few months, when he formed a partnership with Mr. Birnie and engaged in the wholesale monumental business at their present location. They have a well-equipped plant and employ 30 hands, their trade extending all over the country. Mr. Diack is vice-president of the National Association of Granite Industries of the United States, and president of the Granite Manufacturers' Association of Quincy. He is also one of the directors of the Mt. Wollaston Cemetery, a member of St. Stephen's Chapter, Quincy Commandery, and Aleppo Temple, F. and A. M., Mt. Wollaston Lodge, Manet Encampment and Shawmut Canton, I. O. O. F., and is chief of Clan McGregor. He served two years as a member of Quincy City Council.

THE FIRM OF JOSS BROTHERS COMPANY, Quincy, was established in 1882, and is one of the oldest in that section. The business was carried on by John and James Joss, under the firm name of Joss Brothers, until 1895, when it was incorporated under the present name.

They have an up-to-date plant consisting of polishing mill and cutting sheds covering about an acre of ground. A 125 horse-power boiler and engine furnishes power for their machinery and air compressor. Pneumatic tools, surface cutters and all the most modern machinery is in use in all departments and two 15-ton traveling cranes are used in the polishing mill and cutting sheds. While the

major part of their orders call for monuments in Quincy granite they use considerable Westerly and other New England granites. They employ from 25 to 30 men, and have earned a reputation for a high standard of quality in the work which they turn out. Of the recent public monuments cut by them mention can be made of the Soldiers' monument in Sandwich, Mass., shown on another page. This monument, standing 35 feet high and 8-6 square at the base, is surmounted by a statue of a soldier at parade rest. They recently furnished a soldiers' monument for Melrose, Mass., and one of the memorial monuments on the Chattanooga battlefield was made by them.

John Joss was president of the company from its incorporation to the time of his death in 1906, when he was succeeded by Mr. Jonathan Dinnie. James Joss, the present manager, who has also been treasurer of the company since it was incorporated, is a native of Huntly, Aberdeenshire, Scotland, but came to the United States in 1871, when but a young man. Since 1901 he has been treasurer of the Granite Manufacturers' Association, of which he is an active member, and is also a member of the Quincy Board of Trade.

ANDREW MILNE, of the firm of Milne & Chalmers, Inc., Quincy Adams, and Summer street, Boston, is one of the oldest men in the granite business in Quincy. He was born at Aberdeenshire, Scotland, February 13, 1841, and when twenty-eight years of age he came to this country and settled in Quincy, learning the polishing trade in the yard of McKenzie & Patterson. He worked as a journeyman until 1880, when he became associated with John Wiley, George Chalmers and W. A. Smith, and formed a partnership under the firm name of Milne & Chalmers at South Quincy. In 1904 the firm dissolved and Mr. Milne bought the business, and two years later it was incorporated under its present name, with Andrew Milne, president; Mary B. Milne, treasurer, and James Milne, clerk. In 1910 he, together with J. L. Miller, Henry McGrath, Reed & Vendret, P. T. Fitzgerald, and later, his son James, daughter Mary, and Peter E. Vendret formed a corporation under the name of the Bay View Quarry Company, and bought the well-known Field & Weld quarries, the officers being Messrs. Miller, president; McGrath, vice-president; Reed, treasurer, and Milne, secretary.

Milne & Chalmers do a large retail business throughout New England and employ sixty hands. His son, Thomas, is a traveling salesman for the house, and another son, Andrew, is senior member

of Milne & Hector of Quincy Adams. Mr. Milne is a member of Wollaston Lodge, St. Stephen Chapter, Boston Council, Quincy Commandery, Aleppo Temple, A. A. O. N. M. S. of Boston. He is an extensive operator in real estate, being president of the President Hill Real Estate Trust, also of President Hill Annex Real Estate Trust, and secretary of Cranch Hill Real Estate Trust. He is one of the incorporators of the First Presbyterian Church Society, was president of its Building Committee and chairman of the Church Remodeling Committee.

JOHN L. MILLER, Quincy Adams, is a native of Truro, N. S., where he was born January 1, 1854. He was apprenticed to the iron foundry trade at which he worked four years when on December 31, 1872, he went to Quincy and was employed by the O. T. Rogers Granite Company. Two years later he went to Dix Island, Maine, and after a short time returned to Quincy, working for Fredericks & Field four years, when he organized the Merry Mount Granite Company, in which he held the position of manager seven years. He then became associated with W. H. Thomas of Saratoga Springs, N. Y., and they established the firm of Thomas & Miller, which continued twelve years, when he bought his partner's interest. His plant covers an area of over 70,000 feet, and is equipped with the latest improved machinery to facilitate the manufacture of the high-class work for which he is noted, and which is sent to all parts of the United States and many foreign countries. Besides his large manufacturing interest, Mr. Miller is a director of the Bay View Quarry Company, chairman of the Quincy School Committee, of which board he has been a member since 1903, chairman of the Board of Trustees of the Wollaston Baptist Church, director of the Y. M. C. A., and a member of the Quincy Board of Trade. He served as president of the Quincy Granite Manufacturers' Association five years and as vice-president of the National Association. He is also ex-president of the Massachusetts Retail Monument Dealers' Association, a member of the Boston Chamber of Commerce, and an officer in the National Association of Retailers.

THE FIRM OF J. O. GOLBRANSON & Co., Quincy Adams, is composed of John O. Golbranson and John S. Anderson. Both are natives of Sweden, Mr. Golbranson being born at Guttenberg, June 23, 1872, and came to Quincy in 1893, where he was employed by Swingle & Faulkner seven years. He then worked for Fred Barnicoat six years, where he became associated in business with Mr.

**Anderson.** Mr. Anderson was born near Stockholm, January 23, 1874, and came to Quincy in 1893, going to work for McIntosh & Sons, where he remained eight years. He then was engaged by Fred Barnicoat five years, when he joined Mr. Golbranson in business. They started in a yard on Centre street, where they remained until about two years ago, when they bought the M. E. Cook & Co.'s plant, where they are now located. They employ about 25 men and do a wholesale business all over the United States.

**THOMAS BISHOP,** of Thomas Bishop & Co., Intervale avenue, Quincy Adams, is a native of Cornwall, England, where he was born February 11, 1867. His father, William H., owned a quarry in Cornwall, and his nine sons were taught the trade of stone cutting. Thomas came to Quincy in 1888, and was employed in the yard of Craig & Richards two years, when he went to work for McDonald & Sons, and one year later he was engaged in constructing the Ames Building at North Easton. In 1892 he became associated with his brothers in business. They are William, James, John H., Joseph, Alfred, Charles, Richard, Benjamin and Edwin, the last two being twins. They remained on Centre street two years, when they moved to Nightingale avenue. The brothers dissolved partnership, and Thomas and Joseph took the business and they moved to their present location in 1896. In 1903 Joseph sold his interest to Thomas, and he has conducted it alone ever since. His plant is equipped with all the latest improved tools and appliances, and he gives employment to twenty hands. He is associated with his brothers in the ownership of a quarry and a polishing mill. William died in May, 1888, and John, in April, 1906, but the remaining brothers, together with A. M. Smart and Mr. Lacount, constitute the Lincoln Polishing Company. Joseph, Thomas, Alfred and Charles, as the Bishop Brothers' Quarry Company, own a large quarry at Quincy, and Joseph, Thomas and Charles own the Golden Pink Quarry at Niantic, Conn. Each of the brothers are also engaged in the cutting business, Alfred and Charles on Nightingale street, Edwin and Benjamin as partners on Brooks avenue, Joseph on Intervale street, and Bishop & Lacount on Brooks avenue. Thomas was a member of the Quincy Common Council in 1908 and 1909, is a member of the Board of Trade, and the Royal Arcanum.

**JOHN CHRISTOPHER BALLOW,** Quarry street, Quincy, is a native of Cambridgeport, Mass., where he was born April 3, 1852.

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He went when a child with his parents to Quincy, and after a few years in school worked at the milk business, which he abandoned more than a quarter of a century ago, and engaged in the business of teaming stone. Incidentally it may be mentioned that he moved the first load of stone cut in Quincy for Jones Bros.' Company. A few years later he became associated with Walter Fagan and under the firm name of Fagan & Ballow they bought the Henry Barker & Bros.' quarry and carried on the business of quarrying and cutting granite. Mr. Fagan retired after several years and Mr. Ballow continued the business, leasing what is known as the old Greenleaf estate from the Pattee heirs. This property covers more than nineteen acres and includes one of the best quarries in the country. Mr. Ballow has spent a large amount of money in developing this property, and has erected large cutting and polishing sheds, in which are installed all the latest modern machinery and appliances. The large engine house is a model of its kind, and furnishes steam and compressed air for the entire plant. Mr. Ballow gives employment to thirty men, and his trade extends to all parts of this country and Europe. He is a member of the Quincy Board of Trade and Building Trade Association of Quincy.

THE EMPIRE POLISHING COMPANY, Penn street, Quincy Adams, although established but eight years, has attained a leading place among the granite manufacturers in that section. As polishers they do a large business, although their trade is confined to the cutters located in their immediate vicinity, but the volume of trade is sufficient to keep their large plant, consisting of 14 polishing machines and other up-to-date machinery, run to the limit of capacity. A distinct feature of their business is that of supplying compressed air and power for the eleven firms for whom they do the polishing. To do this work they have installed a 1400-feet air compressing engine, the largest in Quincy. This is in addition to one of 560 and of 390 feet, respectively. Two 250 horse power boilers and 150 horse power Corliss engine furnishes the motive power. The firm also own the plant on which the Quincy Avenue Granite Company are located. It is the largest plant in the world for granite polishing.

The members of the firm are John A. Clark, who was born in Edinburgh, Scotland, August 23, 1870, but left there for Kingston, Ontario, in 1878, where he lived until 1885, when he went to work in the iron mines. In 1890 he went to Chester, Mass., and worked one year in the polishing mill of Hudson & Chester Granite Company.

He then went to Quincy, and was employed by McKenzie & Patterson, and then went to Cambridge. Two years later he went to Plymouth, where he worked two years, when he returned to Quincy and was employed by Swingle & Falkner. After six years he formed a partnership under the firm name of Clark, Martin & Chalmers, but a few months later Mr. Chalmers resigned and the name was changed to its present title. Mr. Clark is treasurer of Manet Council, Royal Arcanum, and is a member of Clan McGregor. Angus D. Martin is a native of Caledonia, P. E. I., where he was born May 18, 1871. He left there when twenty years of age and went to Quincy, finding employment with A. M. I. MacLeod for three years, when he went with the Eagle Polishing Company, and then with the Mitchell Polishing Company, where he remained until he became associated in business with Mr. Clark. He is a member of Clan McGregor, and in 1913 was elected Chief of the McGregors, No. 5, of Quincy, an unusual honor, as he never before held an office in that order.

WILLIAM H. DEACON, proprietor of Deacon Brothers' establishment, 109 Centre street, Quincy Adams, is a native of Princetown, Devonshire County, England, where he was born November 16, 1861. After learning the stone-cutting trade with his father, Walter Deacon, he worked as a journeyman in England until 1884, when he went to Quincy and was employed by Adam Vogel & Sons about one year, and with other firms until 1889, when he became associated with John Cole under the firm name of Cole & Deacon, and established cutting yards on Centre street. About eighteen months later Mr. Deacon bought Mr. Cole's interest and joined his brother Walter in business under the firm name of Deacon Brothers, which was continued until 1906, when Mr. Deacon bought Walter's interest and has continued the business alone. His plant is one of the best in Quincy, embracing cutting sheds, polishing and sawing shops, all of which cover an area of more than 35,000 square feet. He gives employment to thirty-five hands, and his plant furnishes compressed air to other shops, he using a 150 horse power engine. He cuts all kinds of monumental, cemetery and building stones, which are shipped to all parts of the United States. Mr. Deacon is a member of Rural Lodge, St. Stephen Chapter and Quincy Commandery, F. and A. M., a charter member of Granite Lodge, Sons of St. George, the Board of Trade, and is a vestryman of Christ's Episcopal Church. He also served in the City Council, 1907-1908.

JOHN THOMPSON & SONS, Quarry street, Quincy Adams, is one of the oldest manufacturers of all kinds of domestic granite in this section, having been established about half a century ago by Smith Brothers. In 1873 John Thompson and his sons, W. and J., bought out the business. The former learned the stonecutting trade in Scotland and the sons in Quincy.

Thompson, Senior, died in 1897 and the sons continued it until their death. William died in 1898 and James in 1910. The latter served the city on the Board of Assessors, president of the Common Council, and as Mayor, holding the office of chief executive during 1895-96-97. A son of William, John W. Thompson, joined his uncle after leaving school and has conducted the business for both estates since 1910. He is a native of Quincy, where he was born December 25, 1875.

RICHARD GORDON, proprietor of the Columbia Granite Works, corner of Columbia and Centre streets, Quincy Adams, is a native of Aberdeenshire, Scotland, where he was born March 4, 1858. He was apprenticed to a stonecutter in 1874, and after serving five years worked as journeyman until 1885, when he went to Quincy in the employ of J. Thompson & Sons. Eight years later he was engaged by Cook & Watkins as superintendent of their yard at Quincy, and then went to Scotland as their resident manager. Two years later he returned to the yard in Quincy and as manager until 1893, when he became associated with John McQueen under the firm name of the Columbia Granite Works, R. Gordon & Co., proprietors, and bought the yard formerly owned by S. Henry Barnicoat. Three years ago Mr. Gordon bought Mr. McQueen's interest, and is now sole proprietor of the works. He employs 15 men and does a large wholesale monumental business all over the United States. Of the many fine monuments he has cut we may mention the Webb and the Kaetsner pieces at Chicago, Ill. Mr. Gordon is a life member of Operative Lodge, F. and A. M., of Aberdeen, Scotland, and of the Scots' Charitable Society of Boston.

THE FIRM OF HUGHES & JOHNSON, Quincy, Mass., is composed of Roland Hughes and Andrew Johnson. Mr. Hughes was born in Wales, England, June 8, 1872, and came to this country in 1892 and settled at Quincy, finding employment in the cutting yard of John Walters. Three years later he worked for Swingle & Falconer, where he remained until he became associated with Mr. Johnson.

Mr. Johnson was born at Eslof, Sweden, May 2, 1874, and came to Quincy in 1892, working for Swingle & Falconer eleven years, or until 1903, when he and Mr. Hughes started business in a small shop, nearly adjoining their present plant, which they built two years later. They employ thirty men and do a large wholesale business in all kinds of cemetery and monumental stones all over the country. Their plant is a model of its kind, and fully equipped with all the latest tools and machinery.

Both gentlemen are members of the Rural Lodge, F. & A. M.; St. Stephen's Chapter, R. A. M.; Boston Council, R. and S. M.; Quincy Commandery, K. T., and Aleppo Temple, A. A. O. N. M. S.

**ALEXANDER FALCONER**, Quincy Adams, is a native of Aberdeenshire, Scotland, where he was born October 14, 1854. He served three years at his trade, and in 1877 went to St. Catherines, Ontario, where he was employed building the Welland canal. Two years later he went to Buffalo and New York, working until 1891, at which time he moved to Quincy, where he was employed three years. He then bought what are now the Falconer quarries and engaged in the contracting business dealing in monumental, edge and paving stone. He is also one of the stockholders of the Blue Hill Quarry at West Quincy, and is a wholesale dealer in monuments. Mr. Falconer was a member of Quincy Common Council in 1895-96, and of the Board of Assessors, 1909-10-11. He is past treasurer of Rural Lodge and is a member of the Council Commandery and Knight Templars, F. and A. M., also Clan MacGregor.

**THE FIRM OF LONG & SAUNDERS**, Quincy Adams, is composed of Charles W. Long and William L. Saunders. Mr. Long was born in Maine and learned the stone-cutter's trade, after which he moved to Stoughton, Mass., where he resided until he moved to Brockton. He was employed as traveling salesman by Thomas, Miller & Co., which position he held until 1890, when he became associated with Mr. Saunders. He is a member of F. and A. M., and the Sons of Veterans. William L. Saunders is a native of Gloucester, Mass., where he was born July, 1849. After leaving school he followed the business of his father—that of fisherman—a few months, and then went to Quincy, and was apprenticed to Churchill & Hitchcock, stone cutters. Two years later he secured a position with George Barker & Co. of Gloucester, stone cutters, where he remained six years. He returned to Quincy and was employed by the Mitchell Granite Company, and later by Friend & Field, until 1890, when he

became associated with Mr. Long, and leased the yards they now operate. In 1907 they bought a quarry at Freeport, Me., consisting of twenty-seven acres, from which they quarry a very fine light building stone. This firm does a large business in monuments of all kinds, and has cut some very notable pieces, one of which, the soldiers' monument at Brockton, Mass., is pictured in this volume. Among others may be mentioned statue monuments at Sharon and Whitman, Mass., two at Belfast, equestrian statues at Danvers and East Walpole, Mass., and a very large memorial at Haverhill. Mr. Saunders is a member of Cape Ann Lodge, K. of P., and the A. O. U. W.

FORBES CRAIG, Gilbert street, Quincy Adams, is a native of Aberdeenshire, Scotland, where he was born January 10, 1857. After leaving school he was apprenticed to a stonemason in Aberdeen four years, after which he worked until 1882 as a journeyman. He went to Quincy and was employed by McPherson & Patterson and months later he went to work for McDonald & Sons. In 1891 he became associated with several stonemasons and they formed a partnership under the firm name of A. M. Deane & Co., but less than two years later Mr. Craig joined Mr. Hector under the firm name of Craig & Hector. In 1894 Mr. Hector retired and the business was incorporated under its present name, the Forbes Craig Company, Mr. Craig's three sons being admitted to the firm. They do a large business throughout the United States. The plant covers more than 20,000 square feet, and is equipped with all the latest machines and appliances, while they give employment to about forty hands. They are also stockholders of the Quincy Adams Quarry Company. Mr. Craig is a member of Rural Lodge, St. Stephens Chapter, Quincy Commandery, Aleppo Temple and the Eastern Star, F. and A. M., Clan MacDougall, Order of Scottish Clans, Scots' Charitable Society and president of the board of trustees of the First Presbyterian Church of Quincy.

THE FIRM OF PROUT BROTHERS, Quincy, is composed of George, Richard, and William Prout. They are natives of Cornwall, Scotland, where George was born, January 15, 1865; Richard, April 3, 1866, and William, August 8, 1867. Their father was a stone cutter, and worked in Cornwall, and in this country, and with whom George learned his trade. In 1873 the family moved to Rawley, Mass., and in 1876, to Quincy, where the brothers were employed until 1889, when they formed a partnership and located in a small shed on



PLANT OF HUGHES & JOHNSON, QUINCY, MASS.



CUT BY FORBES CRAIG, QUINCY, MASS.



PHILIP PINEL AND SET OF STONE CUTTING TOOLS MADE BY HIM.



SOLDIERS' MONUMENT, SANDWICH, MASS.  
*Cut by Joss Brothers Co., Quincy, Mass.*

Garfield street. In 1902 they bought their present up-to-date plant, where they have 45,000 square feet of land, on which, beside the cutting shed and polishing mill, is a convenient and commodious cutting yard. They employ 35 hands, and do all kinds of cemetery work of the highest grade. The soldiers' monument at Uxbridge, Mass., and the McCormack monument at Mount Calvary, Boston, are samples of their work.

George is a member of I. O. O. F. and the Order of Moose. Richard, of Rural Lodge, Wollaston, F. and A. M., and William, of the Sons of St. George.

THE PINEL TOOL COMPANY, 242 Water street, Quincy Adams, is composed of Alfred Pinel and his son Alfred P. J. Mr. Pinel, Sr., was born at Jersey Channel Island, England, April 5, 1852. He learned the blacksmith trade with his brother, Philip Pinel, and in 1872 went to Quincy, finding employment with Charles H. Hardwick & Co., and later with Frederick Fuller. He then became associated with his brother, Walter P. Pinel, and under the firm name of Pinel Brothers engaged in the tool manufacturing and blacksmith business, which they conducted eighteen years. Alfred bought his brother's interest and later he sold out and formed the Gifford-Pinel corporation which in turn sold to the Vulcan Tool Company. The same year the present firm was established and in 1908 they built their present up-to-date plant where they do blacksmithing in all its branches as well as manufacturing granite cutters and contractors' tools of various kinds. One of their most celebrated inventions is a boltless surface Bush hammer chisel, patented February 11, 1908. They were also the prime movers in the introduction of drop forged hand bush hammers. A. P. J. Pinel is a native of Quincy, where he was born March 17, 1875.

In 1892 he learned his trade with Pinel Brothers and after eight years went to work in the United States Navy Yard at Charlestown, Mass., where he had charge of the making and repairing of all tools used by the construction and repairs department. Four years later he accepted a similar position at the Fore River Shipbuilding and Engine Company at Quincy, Mass. In 1907 he became traveling salesman for the Gifford-Pinel Company, and when they sold out to the Vulcan Tool Company, built the shop now occupied by the Pinel Tool Company and started business under that name in 1908, being joined the following year by his father, who had been acting in the meantime as manager for the Vulcan Tool Company.

Three other sons of Alfred Pinel are also employed by the firm, viz., Philip John, Joseph Walter and Edgar Leigh.

The case of tools shown in this volume was made by Philip Pinel about forty-five years ago and is a miniature sample of probably every kind of tool used in the quarrying and cutting of stone at that time. They were exhibited at that time on the Island of Jersey and received first prize and were also exhibited about 1885 at the Masonic fair in Quincy, Mass.

Few stonecutters can name every tool in the case, and it is safe to say that not one in a thousand who has learned the trade since pneumatic power came into use can do so. The thirty tools with their walnut handles weigh less than one pound. In those days all tools were made of iron with steel welded only on the working ends and not of steel as they are now, and were made by hand, the steam or trip hammer not being used.

NAPOLÉON Z. REED AND ARMOND VENDRET compose the firm of Reed & Vendret, of 43 Vernon street, Quincy. Mr. Reed is a native of Canada, where he was born April 14, 1865. When a baby his parents moved to Lawrence, Mass., and later to Newmarket, N. H., and Biddeford, Me. Mr. Reed went West and worked as a stone driller in Graniteville, Miss., two years, when he went to Quincy and was employed by John Thompson & Sons six years, and later by Friend & Field; also by McDonald & Cook. In 1900, he started in business with William Souden, under the firm name of Souden & Reed, but the firm dissolved eighteen months later, and Mr. Reed conducted business alone until he became associated with Mr. Vendret. He is a member of Knights and Ladies of Honor, Clan McGregor, and Order of the Moose.

Mr. Vendret was born in Paris, Me., March 28, 1860. His first experience in the granite business began in 1873 in Paris, and in 1888 he went to Quincy and was employed by John Miller, and by McSweeney & Jones, until 1902, when he entered the present firm. He is a member of Knights and Ladies of Honor, the Franco-American Society and the A. O. F.

JOHN C. MURRAY, of Quincy Adams, was born at Aberdeenshire, Scotland, November 2, 1858. He served three years as cutter and builder, and in 1882 went to Quincy, where he found employment with McKenzie & Patterson, for whom he worked one year, when he was engaged as foreman on the work of extending the

railroad between Reading, California, and Jackson, Oregon. Two years later, by order of the government, the work was suspended on account of insufficient construction, and Mr. Murray returned to Quincy. He worked as a cutter until 1895, when he engaged in manufacturing, his trade extending all over the country.

Mr. Murray was a member of the Executive Committee of the National Association of Granite Industries of the United States for six years and from 1909 to 1911 was president of the Quincy Association. He was elected two years to the Quincy Common Council, and was a delegate from Quincy to the conventions of the National Retail Dealers' Association. Mr. Murray is a member of Operative Lodge of Scotland, F. and A. M., Clan MacGregor and the Scottish Clans.

FRED BARNICOAT, Intervale street, Quincy, is a native of Cornwall, England, where he was born April 7, 1857. After serving an apprenticeship of five years he went to Westerly, R. I., in 1881, and worked as a carver for the New England Granite Works and the Smith Granite Company for five years. He then was employed a short time in Boston, when he moved to Quincy and engaged in business on Liberty street, being the first to cut granite statues in Quincy. Four years later he moved to his present plant, which is thoroughly equipped with every appliance to facilitate the cutting of statues and other high-grade monuments. He manufactures about 50 statues yearly and gives employment to 30 men, he making a specialty of Westerly granite statues and monuments. Among the more notable pieces cut by him may be mentioned those to the memory of Robert J. Smith, at Spring Grove Cemetery, Cincinnati; Andrew Keck, at Evansville, Ind., and the Soldiers' and Sailors' monument at Wareham, Mass.

Mr. Barnicoat, about six years ago, bought out the Crumb Quarry Company of Westerly, R. I., producers of the famous blue-white granite that has a wide sale. This company, which was incorporated under the laws of Massachusetts, employs about 50 men. He is a member of Rural Lodge and Quincy Chapter, F. and A. M., and the Sons of St. George.

JOHN LAVERS, proprietor of the Lavers Granite Company, Copeland street, Quincy, was born in Cork, Ireland, July 18, 1846, and went to New York in 1864, and later to Northbridge, Mass., where he remained three years, when he moved to Diamond Hill, R. I. In 1870 he went to Quincy and was employed by Churchill

& Mitchell as stonecutter, but shortly afterwards was engaged as manager of the Merry Mount Granite Company, a position he held for ten years. After four years as manager for another granite company he started in business for himself as sawyer, polisher and cutter. His plant is well equipped with all the latest machinery for doing first-class work, and he employs 25 men. Besides polishing and sawing he cuts all kinds of monumental work, which is sent to all parts of the country. Mr. Lavers is interested in the Quincy Avenue Quarry Company and the East Milton Quarry.

#### BOSTON.

THE FIRM OF COOK, WATKINS & CO., 219-223 Columbus avenue Boston, dates from 1891, at which time John F. Cook and George R. Watkins became associated in business under the firm name of Cook & Watkins, with offices at 120 Boylston street. At that time they operated cutting plants at Quincy and Barre, with offices at Aberdeen, Scotland, and later controlled the output of the Pleasant River Quarries at Addison, Me. They now have a large wholesale business in Barre, Quincy, Westerly, and other New England granites and marble, and are large importers of Scotch and Swedish monuments and Italian marble statuary. Their monuments and statuary are sold to the trade all over the United States, they employing a large force of traveling salesmen for this purpose. Their output is large, and includes everything in their line from the simplest markers to military and other public memorials. The soldiers' monuments at Morgantown, West Virginia, and at Bar Harbor, Maine, are examples of their work in that line.

Mr. Watkins died in 1896, and Mr. Cook carried on the business under the same name, until 1907, when he retired from active business, and Bradford C. Patch took its management. In 1910, Mr. Patch was admitted a partner, and the firm name changed to its present title.

Mr. Cook obtained his first experience in this business from his father, who carried on a retail and manufacturing business at Portland, Me. Later he established a business at Holyoke, Mass., which he later sold to his brother, who continues it at the present

time. Mr. Cook then engaged as salesman with the Vermont Marble Company, with whom he remained twelve years, until he engaged in business with Mr. Watkins. Mr. Watkins was for years a salesman for W. C. Townsend of Zanesville, Ohio.

Mr. Patch is a native of Vermont, where he was born July 25, 1876. He was educated at the People's Academy at Morrisville, Vt., and at Burdett Business College, Boston, after which he was employed as traveling salesman by Cook & Watkins. Later he was in charge of their Barre office, and then manager of the Boston office.

THE COMMONWEALTH OF MASSACHUSETTS was the first to erect on any battlefield of the Civil War (1861-1865) regimental monuments to mark the position of its commands on that field, and William B. Van Amringe of Boston, then representing the Smith Granite Company of Westerly, R. I., was the first man to sell and erect a Massachusetts Monument on Gettysburg battlefield, and this monument was soon followed by twelve others, by the same firm. While representing the above-named firm, Mr. Van Amringe had entire charge of all their military work; in fact, it may be said that he practically established this new department of work, and has been largely instrumental in bringing it to its present commanding position in the trade.

The Van Amringe Granite Company, incorporated in 1899, purchased the equipment of the Boston office of the Smith Granite Company, and for the past thirteen years has continued to make a specialty of military monuments, as may be appreciated by the fact that since the sale of the first State monument for Gettysburg in 1885, Mr. Van Amringe has sold during the twenty-seven years, military and public memorials alone, amounting to over three-quarters of a million dollars. This amount does not include any private work by the Van Amringe Granite Company, who have sold and erected during that period family memorials costing in the aggregate even a much larger amount than the total cost of military memorials.

The military work of the Van Amringe Granite Company may

be found on nearly every battlefield of the Civil War, as well as many memorials commemorating Revolutionary battles.

The contracts for these numerous and interesting memorials have been awarded to this firm by the committees or commissions appointed by the United States Government, for the several States, which committees were empowered to expend the appropriations made for such purposes. The award of the contract, in the majority of the cases, was the result of public competition, for both design and construction of the memorial.

Owing to the large experience of the members of this firm in connection with the military memorials throughout the country they have become so favorably known to the national and state officials, having such work in charge, that but few of the contracts for memorial work intended for town or city, battlefield or National Military Park, are finally made, without this firm being invited to submit designs, or bids for the same, in competition.

One of the strong assets of the Van Amringe Granite Company is their very large and complete collection of designs and models, together with perhaps the largest and most varied collection of granites to be seen anywhere in the world. This collection of granites affords the prospective customer an opportunity of comparison and values, and one can practically view in their warerooms, samples of all the monumental granites quarried in America, or in foreign lands. With a fine collection of over four thousand designs for memorials, one thousand or more of which designs are for military memorials, no individual or committee visiting the company's offices, 172 Tremont street, Boston, can fail to see and obtain, if they feel so disposed, any kind of a memorial from a small, inexpensive head-stone, to the more impressive monument, or mausoleum, or beautiful memorials in bronze and granite statuary.

The present offices and show rooms of the Van Amringe Granite Company have been occupied by them since 1903, and are well worth visiting, if only to see the numerous models of statues in both bronze and granite that this firm has executed on the numerous battlefields and National Military Parks.

MR. CHARLES CLEMENTS of 244 to 250 Boylston street, Boston, enjoys the honor and unique distinction of combining with his business as Quarry Owner, Producer, Importer and Wholesale Dealer in Statuary and Granite Work of all kinds, a patented process of producing designs in such an artistic manner as to show perfectly the color and natural size and grain of the stone. So true to nature are these reproductions, that dealers are relieved of the necessity of carrying the different granite samples, thus avoiding the expense as well as the weight of these stone discs. The design accompanying this notice shows the beauty and effectiveness of this really marvellous process of reproduction, and this design, with scores of others, are collected in book form, and sold to dealers, so that they have for instant reference designs in various sizes, and in a great number of American and foreign colored granites. The process has been patented in the United States and Canada, and applied for in foreign countries, and since its introduction has met with flattering success.

Mr. Clements, the inventor, is a native of Zanesville, Ohio, where he was born January 29, 1856. After leaving school he was employed as bookkeeper in his brother George's store, where he remained about eight years. He then engaged with Mr. William C. Townsend at Zanesville, O., wholesale dealer and importer of granite and marble, and a year later represented Mr. Townsend at his marble mills in New York City for three years. In 1885 he came to Boston and engaged in the wholesale business at No. 70 Kilby street, handling all kinds of American, and importing Scotch, English, Irish, Swedish, Norwegian, Russian and German Granites. He remained there several years, when he moved to 180 Tremont street, and in 1912 leased commodious offices at 244 to 250 Boylston street, where he employs a large office force as well as traveling salesmen. In 1890 he became associated with Mr. William C.

Townsend in a quarry enterprise, and purchased the famous quarry from Harris Farnum, comprising sixteen acres of the finest quarry property which is located at West Quincy, Mass., from which is obtained the celebrated extra dark Quincy granite. His partner died a few years later and the quarry property is now owned by Mr. Clements and the Townsend estate.

In 1909 Mr. Clements bought, and is now very successfully operating, a quarry at Ausable Forks, N. Y., which is producing a green granite of most beautiful color and texture, known as "American Killarney Dark Green," for which there is a constantly increasing demand.

Mr. Clements was the pioneer dealer during the existence of the McKinley tariff, to ship different kinds of American rough granite to Scotland, where it was manufactured in keeping with detailed plans he supplied, and then shipped back for delivery to his customers throughout the United States. This condition lasted but a few years, but before it ended (by the change in new tariff rate) he had been imitated in the enterprise by many dealers.

Mr. Clements does a large business all over this country. In fact, he has sent many monuments to various parts of the world, including Australia and the Hawaiian Islands, one of his notable memorials being the monument erected to King Kalakua at Honolulu, H. I.

Mr. Clements is a member of the Granite Quarries and Manufacturers' Association of Quincy, Mass., the Wholesale Granite Dealers' Association of Boston, Mass. He has branch offices at Aberdeen, Scotland, and Carrara, Italy. The large number of ecclesiastical, cemetery and parlor statues executed and shipped from the studios at the latter place attest the wide scope of this branch of his business. His reputation for high-class work and material has enabled him to build up a substantial and prosperous business.



CHARLES CLEMENTS.



ABOVE DESIGN SHOWS NATURAL SIZE AND GRAIN OF GRANITE.



SPECIMEN OF PARLOR STATUARY CUT FOR AND IMPORTED BY  
CHARLES CLEMENTS.



PROPERTY OF CHARLES C. HANNAH, WEST WINDHAM, VERMONT

VIEWS ON THE CHARLES CLEMENTS KILLARNEY DARK GREEN QUARRY PROPERTY DURING EARLY STAGE  
OF DEVELOPMENT, ARTISAN & TRADES, NEW YORK





A CELTIC CROSS MONUMENT BY CHARLES CLEMENTS.

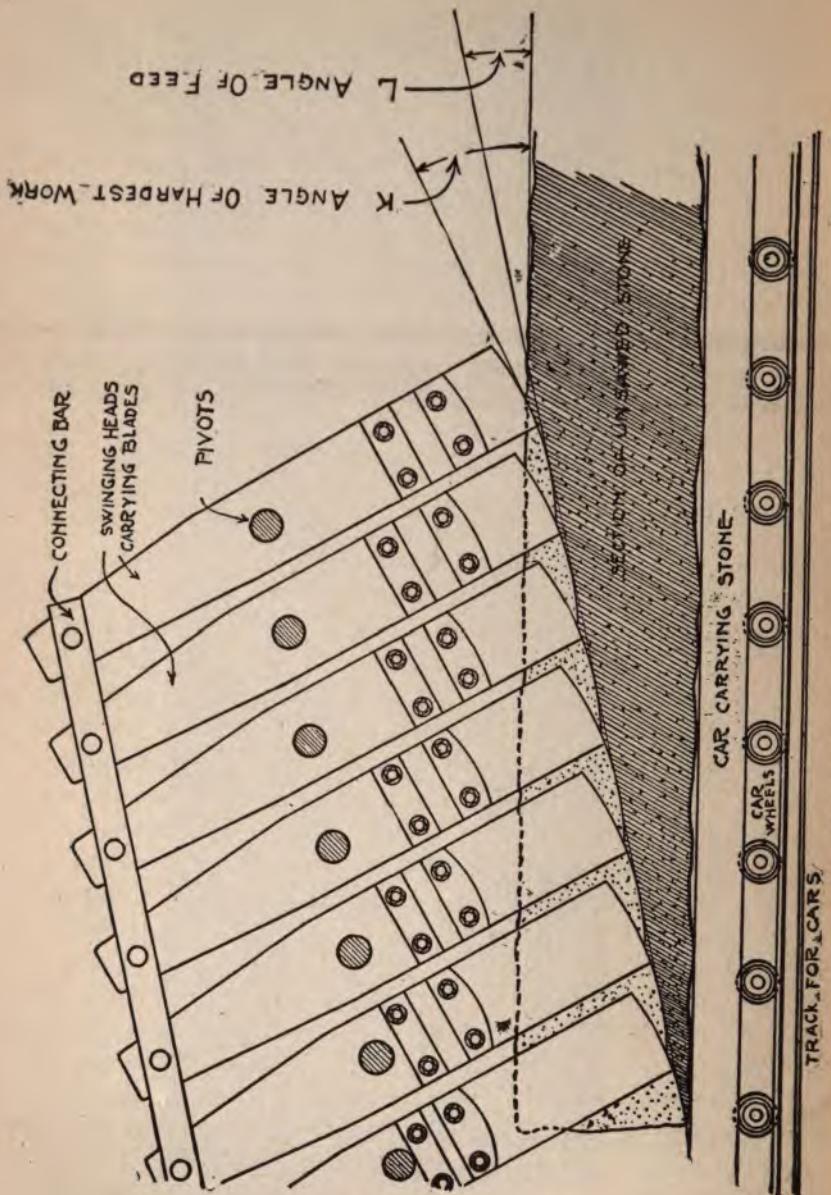
## WORCESTER.

WHEREVER CUT STONE IS PRODUCED, and particularly wherever granite is quarried or cut in New England, there is known the name of George D. Webb, who has been often called one of the pioneers of the granite industry of New England. Mr. Webb started quarrying stone in a very small way and with small means in Worcester, Mass., at Millstone Hill Quarry, which is now a part of Green Hill Park, and no longer used commercially. Limited in his quarry to cellars and foundations for houses, Mr. Webb purchased in 1882 the celebrated Fitzwilliam Quarries at Fitzwilliam, N. H., and in 1885, the quarries at Marlboro, N. H., and established a small cutting shed at Worcester, Mass. It was in 1891 that he organized the Webb Granite and Construction Company, which is operating on a large scale at the present time at the three localities mentioned above. Not satisfied with the limitations of a strictly grey granite proposition, Mr. Webb in 1905 purchased about 400 acres of quarry land at Milford, Mass., his purchase comprising what is a veritable mountain of the Milford Pink and Milford White granite, which is at the present time, perhaps, the granite most popular and most sought by prominent architects of the country. In 1909 Mr. Webb became acquainted with Messrs. Chase & Lanier, two young men from Northfield, Vt., who interested him in a model of a granite saw in which Mr. Webb realized there were great possibilities. After a careful investigation and lengthy tests, this saw was developed to a proposition of such great saving of money and time in the sawing of granite, that Mr. Webb purchased the invention and organized the American Granite Saw Company, which company is now leasing these saws to the granite trade on a royalty basis.

On December 29, 1909, Mr. Webb was thrown from the platform of the New York & Boston Express between Boston and Worcester, and was instantly killed. Thus was removed a man of sterling integrity, ever active and progressive, and a man who was largely responsible for the rapid growth of the cut stone business in New England.

During the year of 1909, Mr. Webb had devoted his entire time and energy to the development of the new saw, and the active management of the Webb Granite and Construction Company and the Webb Pink Granite Company was relegated to his son, Charles F. Webb, and his brother-in-law, Harrie H. Sherman. This

## HISTORY OF THE GRANITE



AMERICAN GRANITE SAW, Standard, Large and Portable, Drawings

## INDUSTRY OF NEW ENGLAND

proved to be a most beneficial arrangement for the two companies, for the sad death of Mr. Webb left them not wholly unprepared, but under the management of two men whose capabilities have ever since been proven by the large and conservative business which has been done by the two companies.

In his business Mr. Webb was known through his trade as a man whose first motto was "quality," and whose second motto was "time." These two mottoes were evidenced in every contract which he took, and were instrumental to the greatest degree in the success which he had. The stone of inferior quality or workmanship was discarded at the quarry or cutting plant, and not at the site of the building for which it was intended; and where the time of the contract was twelve months his efforts and his instructions were to complete the contract in eleven months. These qualities he had impressed upon those who followed him in the conduct of his two companies to such an extent that now they are the maxims of the present organizations. In the case of the Cuyahoga County Court House, Cleveland, Ohio, which was one of the largest cut stone jobs, which either company has had, the entire contract was completed four months before the contract time; and in another case, namely, the New York Post Office, the entire job was shipped a month before it was due to be shipped according to the contract.

Mr. Webb was a firm believer in modernizing his plants to the utmost, and both the Webb Granite and Construction Company and the Webb Pink Granite Company are equipped with the best and most up-to-date machinery for handling and manufacturing granite.

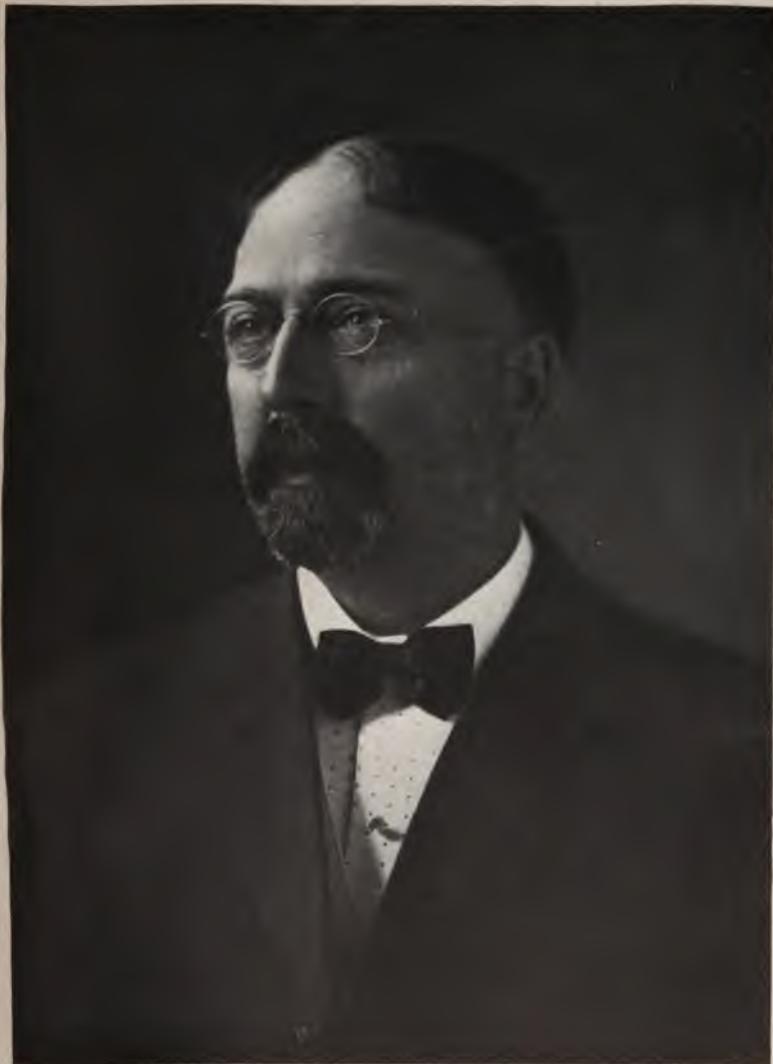
While the history of these two granite companies is so closely interwoven, and the management of them is in the hands of practically the same people, still the products of the two companies are so distinctly different and the operation of the plants and the managements of the businesses so entirely separated that a separate description of the plants and products of the two companies is necessary in order to do justice to them as important factors in the granite industry of New England.

WEBB GRANITE AND CONSTRUCTION COMPANY. From the small beginning outlined above, the Webb Granite and Construction Company owns and operates extensive quarries in Fitzwilliam and Marlboro, N. H., and has built a very large and modern cutting plant in Worcester, Mass. The quarry at Marlboro, N. H., comprises over 100 acres of quarry land, a large portion of

## HISTORY OF THE GRANITE

which has been developed, and is worked both for producing building stone and paving and crushed stone on a very large scale. The paving and crushed stone products, while primarily by-products from the building granite, are of sufficient magnitude to be treated as businesses themselves. A force of paving cutters averaging from 80 to 100 men are employed in the season, and the blocks produced are shipped to all parts of the United States east of the Mississippi River, and these blocks have a reputation of being among the best granite blocks produced for street paving. The crushing plant has a capacity of about 400 tons per day, which utilizes the large part of the waste from quarrying and from paving cutters. The quarry is equipped with six derricks, ranging in capacity from five to forty tons, operated in some cases with steam, and in others with compressed air. All the drilling is done with compressed air drills, and a compact modern compressed air plant furnishes air for the derricks and drills, and air from this plant is distributed to all parts of the quarry. The quarry is connected with the Boston & Maine Railroad by a railroad owned and operated by the Webb Granite and Construction Company, and a powerful locomotive handles the shipments up and down the hill to the Boston & Maine Railroad with great efficiency and eliminates any chance for delays in the prompt shipments of material. Some of the company's cutting operations are carried on at this plant, but as a rule the stock for building products is shipped from here to the main cutting plant at Worcester. The granite from this quarry is considered to have the smallest percentage of iron or salts containing iron of any of the New England granites, and because of this the company supplies a great many tanks varying from the smallest pickling vats to tanks weighing approximately 20 tons to the various steel mills and metal working concerns where pickling or galvanizing vats are used. This granite has shown its peculiar adaptability for this purpose and its acid-resisting qualities have been proven in many instances where tanks cut from this granite have been in constant use for 25 years without showing signs of deterioration. This quality is valuable also where the stone is used for building purposes, as a material which is capable of resisting the action of strong acids over such a long time will certainly withstand the ravages of time and weather for an indefinite period, and buildings in which this granite has been used and which have been exposed to the elements for years, still remain as fresh and bright as though they had been quarried yesterday.

The quarries at Fitzwilliam also comprise a tract of land of



MR. GEORGE D. WEBB,

*Founder of the Webb Granite and Construction Co., Webb Pink  
Granite Co. and American Granite Saw Co.*



NEWARK CITY HALL.



UNITED STATES POST OFFICE, NEW YORK CITY.

*Milford, Mass., Granite, Furnished by the Webb Pink Granite Co., Worcester, Mass.*



CUYAHOGA COUNTY COURTHOUSE, CLEVELAND, OHIO,  
*Webb Granite and Construction Co., Worcester, Mass.*

## INDUSTRY OF NEW ENGLAND

about one hundred acres and are connected with the Boston & Maine Railroad by a railroad owned by the company. This quarry is of more recent development, although various openings had been made many years before the purchase of this quarry by Mr. Webb and the granite taken from its openings has been used and known for many years. This granite is used almost exclusively for building purposes and also to a moderate extent for monumental purposes. The quarry is equipped with a complete air compressing plant, which supplies compressed air to the various large quarry derricks and to all of the drills used on the quarry. There are four derricks ranging in capacity from fifteen to forty tons, and these derricks each cover a large area of the quarry and are served by a sidetrack, which greatly facilitates the efficient and rapid shipment of dimension and rough stone to the market or to the cutting plant at Worcester, where a major part of this stone is worked. The granite from this quarry is whiter in color than the average so-called "Gray Granite" and has a very fine grain and is uniform in texture, rendering it a very acceptable and desirable granite for use in monumental and other buildings.

WORCESTER.—After a large and reliable quarry, the next most necessary adjunct to the business of this nature is the modern and well-equipped cutting plant at Worcester, Mass., while not the largest cutting plant it is without question one of the best-equipped plants in New England. In addition to its granite operations this company has done a very extensive business in the cutting and finishing of soft stone and the Worcester plant has been equipped both for the handling and manufacturing of granite and for the handling and finishing of lime stone, sand stone and marble. The company has gradually been getting away from the soft stone business in which in the past it has been a considerable factor around New England and now devotes all of its energy in the granite field. The Worcester plant covers a level tract of land directly in the city comprising over 400,000 square feet and is served with sidetracks from the Boston & Maine Railroad entering Worcester, over which all of the material is brought down from the New Hampshire quarries to be cut and finished and shipped to all parts of the country ready to be set in the building. There are two large cutting sheds, one of which is equipped with two electric overhead cranes, which travel the entire length of the shed, beyond to the storage yard, with a sidetrack from the main siding across one end of the shed giving facilities for loading cut stone directly from the banker to the car on which the stone is

## HISTORY OF THE GRANITE

to be shipped to its destination. Parallel to this shed is a tramway about 400 feet long and 60 feet wide on which is installed an overhead electric crane of large capacity. A siding is run from the main siding the entire length of the tramway and cross tracks connect the area beneath this tramway at several points to the main cutting shed. This provides a large storage yard and is also utilized for shipping the finished product and unloading and handling the rough stock received from the quarries, distributing it to the saws or surfacing machines or directly to the main cutting shed, as the case may be. Directly under this outside tramway is situated the original Chase patented granite saw, mentioned earlier in connection with Mr. Webb, and a large per cent. of the rough stock coming from the quarries goes through this saw and thence to the surfacing machines directly adjoining it before being delivered to the cutting shed, which proves to be a very efficient and economical method of handling and promoting rapid despatch in the execution of contracts. Parallel to the tramway is a blacksmith shop and a jobbing shop in which all of the cutters' tools are made and sharpened. The jobbing shop is equipped with all of the facilities for handling heavy smithing and almost all of the fittings and heavy work for the plant and quarries is done in this shop.

Beyond and parallel to this shop is another cutting shed, which is served by a traveling crane operated by steam, which is called a "dago." This crane was built by the company and has proved to be a most efficient piece of handling machinery, in that it acts both as a traveling crane and at the same time carries stock for the cutters into the shed ready for them as required, and also carries out the finished stone which it delivers to a derrick at either end of this shed, from which points the stone is loaded for shipment or stored as the case may be. In the main cutting sheds are also situated polishing mills and a modern gang saw, and also a large rubbing bed and various planers for use in connection with the cutting of soft stone. The main office of the Webb Granite and Construction Company, and also of the Webb Pink Granite Company is located adjacent to the Worcester cutting plant, and all of the drafting and pattern work for both companies, as well as the business management of both companies, is carried on from this office.

WEBB PINK GRANITE COMPANY. The quarry and plant of the Webb Pink Granite Company are located in the town of Milford, Mass., about twenty miles from the main office at Worcester. This property comprises approximately 400 acres, practically

## INDUSTRY OF NEW ENGLAND

all of which is quarry land, except the part where the cutting plant and power house are located. This land was untouched for quarry purposes when Mr. Webb first organized the Webb Pink Granite Company and all of the openings, which had been made were comparatively small, although they had been under operation for a number of years in a small way. As a matter of fact none of the original openings are now used by the present company, but it has developed much larger and better openings from which all the products of this company have been quarried.

A system of railroad has been installed leading from the New York, New Haven & Hartford R. R. tracks through that part of the property covered by the cutting plant, and from thence on to the quarry from which numerous side-tracks and spurs serve the various derricks, which are in use at the quarry. A large central power house has been erected between the cutting plant and quarry, and electricity and compressed air generated in this power plant are distributed to all parts of the cutting plant and quarry, as required. Because of the close proximity of the quarry and the cutting plant this central plant has proven to be a very economical and efficient method of supplying power. With the exception of the coal used in sharpeners' forges, not a pound of coal is burnt outside of this central power house. This power house is built of stone and concrete, and has been designed to be as nearly fireproof as possible. When it was first built it was a frame structure, and the necessity of building a fireproof building was demonstrated when it was destroyed by fire in 1908. This would have completely tied up the operations of both the plant and the quarry, if it had not been for the energy of Mr. Webb in immediately arranging for a supply of electricity from the electric company, whose power house was nearly a mile away. The prompt installation of the power from this outside source occasioned the delay of only a week, which was soon made up and none of the contracts which were then under way suffered loss.

In this power plant is installed a 750 H.P cross compound condensing steam engine, which drives three direct current generators, developing 550 kilowatts at 500 volts, and also a 1200-foot belt-driven air compressor. The generators are connected in such manner that they can be used coupled together in various combinations or used independently of each other, rendering a very flexible electric output depending upon the requirements of the cutting plant and quarry. In addition to the compressor, driven by these means, there are two steam-driven compressors.

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each of which is cross-compound condensing and two stage air, with a capacity of 1800 and 1600 feet of air per minute, respectively. These are installed in such manner that they can be run independently of each other or can be used as one big unit. This method of installation gives a flexibility to the output of compressed air which, coupled with the method of the electric installation, makes the plant an economical one to run, whether the requirements of the cutting plant and quarry are small or large.

There are two electrically operated locomotive cranes, which are used for many purposes, such as transportation of cars to all parts of the quarry, switching of cars around to the lower yard into the cutting sheds, and in addition, they also are used for loading cut stone from the storage piles to cars for shipment. Both of these cranes are equipped with air brakes and are run by very powerful motors, capable of handling cars up the rather stiff grade from the cutting yard to the quarries, and they have the advantage of being able to go around very sharp curves, which no locomotive, with equal traction capacity, could negotiate. The cutting plant is well lighted and well ventilated, and is 300 feet long and 60 feet wide with a tramway running the entire length of the shed and beyond the shed about 400 feet, making a total of 700 feet of tramway, on which are installed three traveling cranes, which serve the cutters, and polishing mills in the shed, and also serve the saws and surfacing machines and stock yard under the tramway beyond to the shed. This layout has proven to be a very practical and efficient one, as the rough stock is delivered under the open tramway from the quarry, and is handled by the overhead cranes, either to the saws and surfacing machines, and then to the shed, or directly to the cutters, as the case may be, making the progress of the stone practically continuous from one end of this tramway to the other. The stock passes through the different processes from rough to the finished state, and is then loaded directly on to the cars for shipment by these cranes, or is loaded on the stock cars to be distributed in the storage yard by the locomotive cranes, in case immediate shipment is not possible. Under this tramway are installed two of the Chase patented saws mentioned, and a large battery of surfacing machines and polishing mills, all of which are so located as to render the handling of stone from one to the other in as direct a path as is possible, the idea which is followed out being to have it travel direct and always ahead with little or no lost motion. Alongside and connected to the cutting shed is a completely equipped and modern blacksmith shop where all the cutters' tools are made and

## INDUSTRY OF NEW ENGLAND

sharpened, and delivered to the cutters with the least possible effort. Here is also located a carpenter shop and a well-equipped jobbing shop where the heavy logs and fittings are forged for the entire plant. All of the machines, such as saws and polishing mills and the various tools in the carpenter and blacksmith shop are driven by direct connected motors and the entire shed and yard is piped for compressed air and provided with connection outlets at several points. There are also two large 40-ton derricks in this lower yard, which are used for storing and loading for shipment.

The quarry has been opened in several different places, the main opening being a large and well-spread out opening from which the bulk of the contracts secured by this company have been filled. Both white and pink stock are quarried from this opening and all of the work is handled here by three 40-ton derricks served with side-tracks from the main track of the company. The supply of granite is apparently inexhaustible at this opening and the company is continually enlarging it so that it will not develop entirely downward without the saving feature of spreading outward, the policy being that at the cost of quarrying shall not grow larger as the depth of the opening is increased; and so far this policy has been demonstrated to be absolutely practical and efficient. Other good openings have been made and operated to some extent, but have not been pushed, as the main opening has developed so well that it has been found unnecessary to seek elsewhere for stone to fulfill contracts which the company had to fulfill or might expect to fulfill. There is a known and almost unlimited reserve of virgin quarry on this property, which the company has investigated, all of which shows the foresight of the late Mr. Webb in acquiring and developing the property. The success of a granite concern depends primarily upon the quarry, which it controls, both as to the quality of the granite, and the extent of the deposit, and in this case, both quality and extent are unquestioned.

The management of the two Webb Companies is now in the hands of men who have been trained in the various departments and branches of the granite business by Mr. George D. Webb and he has instilled in them all of the main essentials which made him so successful, and it is their policy not only to carry out the work built up through his ability and business integrity, but also to increase the means and reputation of the two concerns. Mr. Charles F. Webb is now President of the Webb Granite and Construction Company and Vice-President of the Webb Pink Granite Company. Mr. Harry H. Sherman is President of the Webb Pink Granite Company and Vice-President of the Webb Granite and Construction

## HISTORY OF THE GRANITE

Company. Mr. Howard L. Davies is Treasurer of both companies.

Following is a partial list of the representative contracts, which have been executed by the two companies:

Cuyahoga County Court House, Cleveland, Ohio. Lehman & Schmitt.

First National Bank, Cleveland, Ohio. J. Milton Dyer; F. G. Bates, Associate.

U. S. National Bank, Johnstown, Pa. Mowbray & Uffinger.

Central State Bank Building, Des Moines, Iowa. Mowbray & Uffinger.

Gardner Savings Bank, Gardner, Mass. Frost, Briggs & Chamberlain.

Philadelphia Stock Exchange, Philadelphia, Pa. Horace Trumbauer.

People's Gas Light & Coke Co., Chicago, Ill. D. H. Burnham & Co.

John Hancock Mutual Life Co., Boston, Mass. Shepley, Rutan & Coolidge.

National Museum, Washington, D. C. Hornblower & Marshall. East Front Treasury Bldg., Washington, D. C. J. Knox Taylor, Supervising Architect.

U. S. Post Office Building, New York City. McKim, Mead & White.

Sheffield Dormitory, Yale College, New Haven, Conn. C. C. Haight.

Hotel Somerset, Boston, Mass. A. H. Bowditch. Webber Apartments, Brookline, Mass. A. H. Bowditch. Back Bay Station, N. Y., N. H. & Hartford R. R., Boston, Mass. Shepley, Rutan & Coolidge.

Union Station, Baltimore, Md. Kenneth M. Murchison. Pennsylvania, N. Y. & Long Island R. R. Power House, New York City. Westinghouse, Church, Kerr & Co., Engineers.

First Congregational Church, Nashua, N. H. A. P. Cutting. First Church of Christ, Scientist, Boston, Mass. Brigham, Coveney & Bisbee.

Union Congregational Church, Worcester, Mass. Earle & Fisher.

Hudson Memorial, Spuyten Duyvil, N. Y. Babb, Cook & Welch.

Ferguson Fountain, Chicago, Ill. Shepley, Rutan & Coolidge. Newark City Hall, Newark, N. J. J. H. & W. C. Ely.

State Armory, Medford, Mass. Shepley, Rutan & Coolidge.

**ROCKPORT, MASS.**

ROCKPORT IS SITUATED on the most easterly part of Cape Ann, and is bounded northwesterly by Ipswich Bay, on the east by the Atlantic Ocean, on the south by Massachusetts Bay, on the west by the City of Gloucester.

Cape Ann is particularly well fitted for the pursuit of the granite industry, as its rocky hills and shores afford a comparatively inexhaustible source of supply, and its splendid shipping facilities give the advantage of quick and economical transportation to market.

The firm and uniform texture, high crushing test, freedom from impurities, enduring color, and being susceptible to a beautiful and lasting polish, makes Cape Ann granite very desirable for bridges and buildings of the finest architecture.

In a report made by Prof. John H. Sears, curator mineralogy and geology, Peabody Academy of Science, on the nature of the stone in the quarries of the Rockport Granite Company, he says:

"It is a true Hornblende Granite composed of quartz, orthoclase and albite feldspars with Hornblende.

"The accessory minerals are biotit mica, Zircons, fluorite magnetite and garnit.

"Prof. J. E. Wadsworth called the rock Hornblende Granite, this name was based upon its having pink feldspars. Prof. J. D. Dana called it synite, his classification was based upon the Siene Granite of Egypt, the material from which the obelisks and ancient sarcophagus were made. This Egyptian stone is now known by comparison to be a typical Hornblende Granite with the same composition as the Rockport Granite. The toughness of this rock is well known, I have made thin sections of your quarry rock  $1/700$  of an inch thick, the sections one inch by  $3/4$  surface measure, for study under the microscope and there are very few rocks of that size that can be cut so thin without going to pieces.

"Seam face or sap rock of quarrymen are the joint plains or surfaces of original joints in the rock. These surfaces are discol-

ored by iron oxides which come from the iron-bearing minerals, Hornblende magnitite and biotite, which are dissolved by water and carbonic acid, which is percolating through these joint plains and in this process the feldspars on the surface in varying depths from one to six inches are partially kaolinized which upon being exposed to the air and sunlight become carbonized to a semi-silicious porcelain, often harder than the original feldspars.

"Decay in granite or the formation of crumbling granite blocks is due to extreme heat as forest fires or extreme cold as continental glaciation and is in no way comparable to seam face or sap rock formed in the rocks in a quarry. Its weight is 168 lbs. per cubic foot."

Major F. E. Hobbs, of the Ordnance Department, U. S. A., after a test of this granite reports thus:—

Compressed surfaces dressed flat; sides rough.

Dimensions

| Description     | Com.   | Sec. | First | Ut. str'gth per |         |         |
|-----------------|--------|------|-------|-----------------|---------|---------|
|                 | Height | Sur. | Area  | crack           | Total   | sq.in.  |
|                 | In.    | In.  | In.   | Sq. in.         | lbs.    | lbs.    |
| Rockport, Gray  | 2.99   | 3.10 | 3.09  | 9.58            | 212,000 | 321,000 |
| Bay View, Green | 2.87   | 3.01 | 3.02  | 9.09            | 140,000 | 286,400 |
| Bay View, Gray  | 3.00   | 3.03 | 3.03  | 9.18            | 202,000 | 342,000 |
| Bay View, Sap.  | 2.95   | 3.03 | 3.05  | 9.24            | 189,000 | 299,000 |
|                 |        |      |       |                 |         | 32,360  |

The granite is peculiarly adapted for paving blocks, and its excellent quality and reputation for this purpose has resulted in its being largely specified as the standard granite paving, and Cape Ann is one of the large granite paving block producers in the United States. Engineers are more fully realizing that the granite paving blocks of the Cape Ann standard are the only sanitary, durable, and economical pavement for heavy traffic, and this material finds a ready and well-deserved market.

Cape Ann is the headliner among granite centers in furnishing

## INDUSTRY OF NEW ENGLAND.

material for the construction of granite quays and piers, and all classes of jetties and breakwaters.

Up to 1800, no granite was quarried on Cape Ann except for the use of its own settlers. In that year, a mill stone was quarried on an order from Newburyport. In 1823, the industry made its first real start, and up to 1842 furnished all the granite for the United States government fortifications on the islands in Boston Harbor and for the Charlestown and Portsmouth Navy Yards. In 1828, Cape Ann furnished the granite for the Chain bridge over the Merrimac River.

The industry continued to grow, and in 1853 a cargo of underpinning was sent to San Francisco by vessel. In 1857, a cargo of paving blocks was sent to New Orleans, and shipments of Cape Ann granite followed to Cuba and Valparaiso. A large sale was found for this granite for curbing and cemetery work and for building fronts, and, in response to the demand for permanent, enduring architecture, Cape Ann granite is represented today in the large cities and towns throughout the United States in their finest buildings, bridges and monuments.

The Rockport Granite Co. was incorporated in 1864; formerly their property was operated by Eames, Stimson & Co. Soon after the company was incorporated John Stimson became its treasurer and general manager, which position he held until 1881. At that time Mr. Chas. S. Rogers, who had been associated with the company since its incorporation and having served as director and assistant treasurer, was elected its treasurer and general manager, which position he retains still. He is a native of Danby, Vermont, where he was born February 19, 1840. He has been a figure of prominence among the granite proprietors, contractors and architects for many years, and the high esteem in which he is held, has been won by untiring effort for the interests of the industry and his reputation for just and upright dealings in all his relations with men.

From the crude methods first employed in quarrying and handling granite by hand power, and transporting to the shipping point

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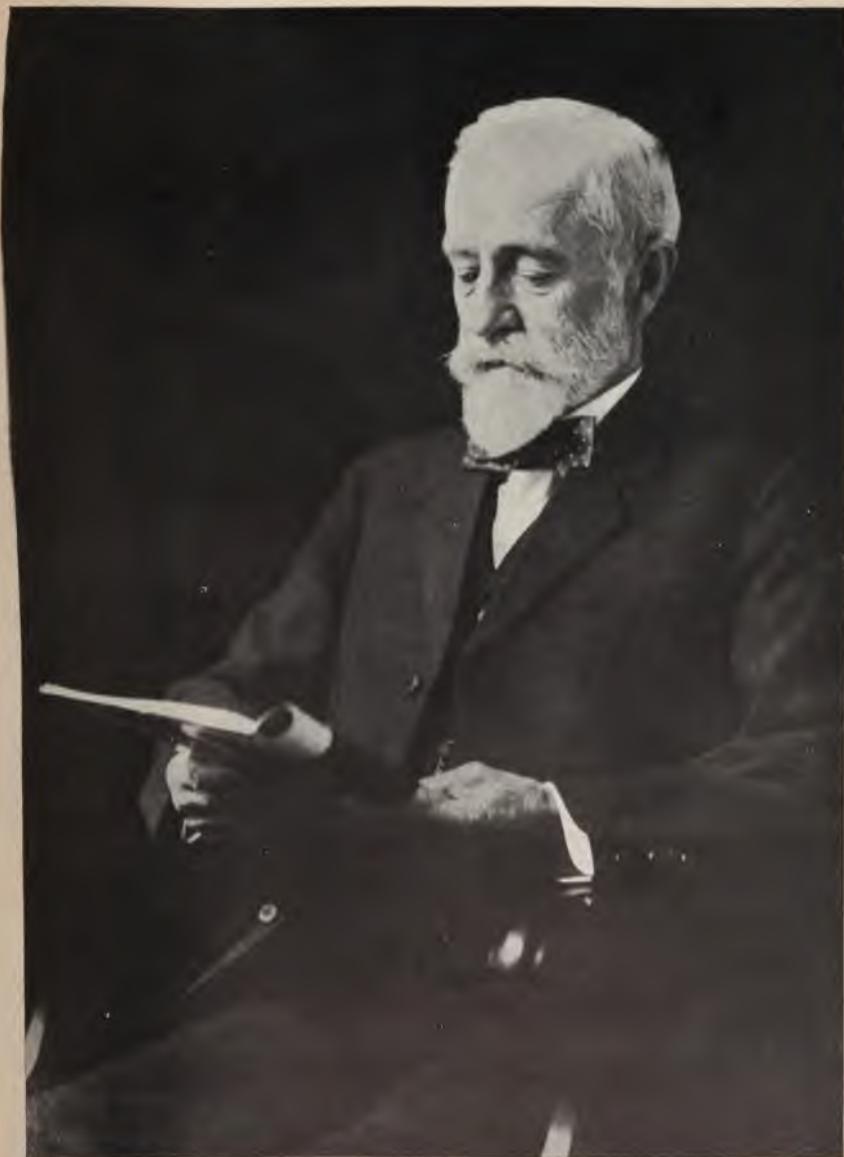
by oxen, the industry has passed successively to the use of the hand derrick in 1836, the steam hoisting engine in 1853, the steam pump in 1854, the quarry railroad in 1870, up to the steam drill in 1883, and to the present use of compressed air for quarrying, hoisting, dressing and surfacing the granite.

The plant of the Rockport Granite Company consists of more than 600 acres of quarry land, finishing, cutting and polishing sheds, wharves, and a fleet of sloops, schooners, barges, tow-boats and lighters. They also charter the best class of coasting schooners, barges and steamers up to 2,500 and 3,000 tons, which enable them to handle contracts of any size promptly and at moderate cost, particularly to the seacoast cities, where water transportation gives them a decided advantage over inland competitors. At the quarries and sheds every modern appliance is utilized that will facilitate their business. These include air compressors with an aggregate capacity of 5,000 cubic feet of free air per minute; forty large modern steam derricks, many of which are capable of hoisting over seventy-five tons; hoisting engines of the latest type; large polishing wheels, lathes, surface cutters, etc.; and they employ from 800 to 1,000 men in all departments.

They own their own railroad system, which connects their quarries with their wharves. The railroad is about seven miles long and besides numerous cars and locomotive cranes three standard gage locomotives are employed. A crushing plant of 300 tons capacity daily furnishes the standard grades of crushed granite.

The Rockport Granite Company consists of the following officers and directors: C. Harry Rogers, president and assistant treasurer; Charles S. Rogers, treasurer; Louis A. Rogers, purchasing agent; directors, Samuel S. Shaw, H. Chester Story, Arthur Binney, Charles S. Rogers and C. Harry Rogers.

Many of the associates of the officers and the superintendents have been with the company since boyhood, and in growing up with the business give an organization of marked ability to execute con-



MR. CHARLES S. ROGERS  
*Treasurer and General Manager Rockport Granite Company.*



THE NEW TOWER, BOSTON CUSTOM HOUSE.  
*Peabody & Stearns, Architects, Boston, Mass.*  
*Rockport Light Gray Granite. Rockport Granite Company.*



ESSEX COUNTY COURTHOUSE AND REGISTRY OF DEEDS, SALEM, MASS.

*Clarence H. Blackall, Architect, Boston, Mass.*



Post Office, BOSTON, MASS.



LONGFELLOW BRIDGE, CONNECTING BOSTON AND CAMBRIDGE.  
*Wheelwright & Haven, Architects, Boston, Mass.*

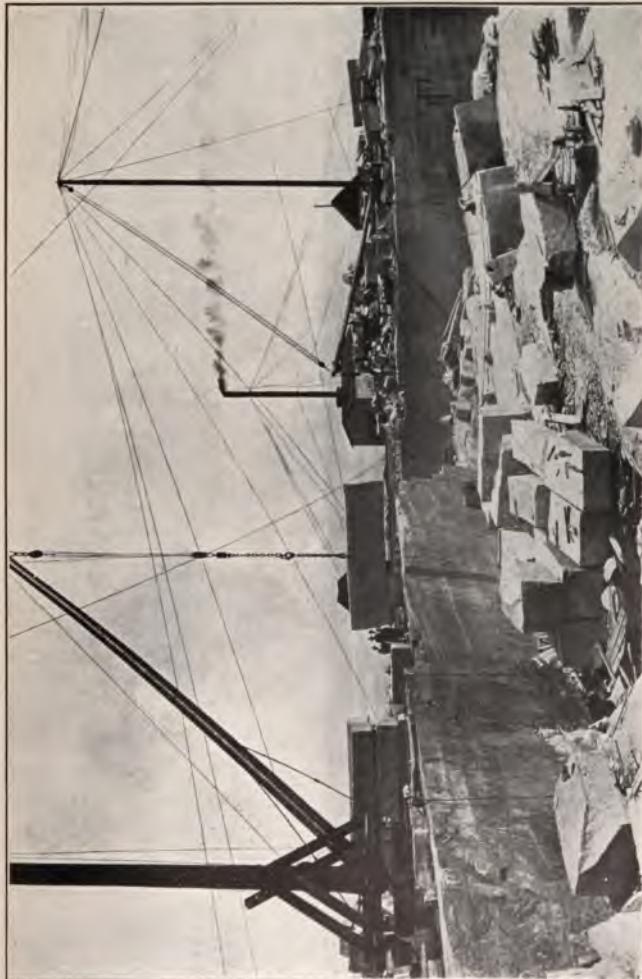


FOUNTAIN OF ROCKPORT "SEA GREEN" GRANITE AT UNION STATION PLAZA,

WASHINGTON, D. C.

*D. H. Burnham & Co., Architects, Chicago, Ill.*

*Rockport Granite Company.*



VIEW OF A ROCKPORT GRANITE COMPANY'S QUARRY, SHOWING A 75-TON DERRICK.



ADDISON E. BULLARD at  
Rockport GRANITE Cos WHARF

ONE OF THE ROCKPORT GRANITE COMPANY'S WHARVES.

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tracts and perform the duties necessary to the successful operation of any concern.

The company has its main office at the home plant, Rockport, Mass. It also has branch offices in Boston, New York and Chicago.

Among the representative contracts in which Rockport Granite has been used are the following:—

### PROMINENT BUILDINGS.

Registry of Deeds and Probate Building, Salem, Mass.

Boston Post Office and Sub-Treasury Building, Boston, Mass.

Suffolk County Court House, Boston, Mass.

Baltimore, Md., Post Office.

National City Bank of New York.

Seigel-Cooper Building., New York.

American Baptist Publication Society Building, Philadelphia.

Real Estate Trust Company Building, Philadelphia.

Green polished columns of the Madison Avenue Presbyterian Church, N. Y.

B. F. Goodrich Company Building, New York.

Eighteen Monoliths for the Peoples' Gas & Coke Company building, Chicago, weighing about fifty tons each, and which are highly polished.

Two tremendous bowls, 3'-0" in diameter, for the Plaza Improvement, Union Station, Washington, D. C.

Lytton Building, Chicago, Ill.

Woolworth Building, Broadway, N. Y., polished base.

Syndicate Building, Minneapolis, Minn., polished fronts.

Woodward Building, Washington, D. C., polished monoliths.

National State Bank, Newark, N. J., polished monoliths and base.

Sharples Building, Chicago, Ill., base.

Hamilton Club, Chicago, Ill., polished base and entrance pilasters.

### PROMINENT BRIDGES.

The new Longfellow Bridge, which connects Boston with Cambridge.

## HISTORY OF THE GRANITE

The great sprandell walls for the Brooklyn Bridge, New York.  
The Williamsburg Bridge, New York.  
The Manhattan and Queens Approaches for the Blackwell's Island Bridge, N. Y.  
The Manhattan Anchorage for Bridge No. 3, New York.  
The University Heights Bridge, New York.

## PROMINENT MONUMENTS.

The Logan Monument, Chicago, Ill.  
Miles Standish Monument, Duxbury, Mass.  
Base for General Scott Equestrian Monument, Washington, D. C.  
(one stone in this base weighed 149 tons in the rough).

## BREAKWATERS AND JETTIES.

Jetties at Key West, Fla.  
Jetties at Sabine Pass, Texas.  
Jetties at Newburyport, Mass.  
Jetties at Mayport, Fla.  
Breakwater at Plymouth, Mass.  
Breakwater at Revere, Mass.  
Dog Bar Breakwater at Gloucester, Mass.  
Breakwater at Sandy Bay Harbor of Refuge, Cape Ann, Mass.  
United States Government Dry Dock at Brooklyn, N. Y.  
United States Government Dry Dock at Norfolk, Va.  
Piers and quays for Navy Yards and the better grade of wharves  
and docks in most of the large seaports on the Atlantic Coast.

Next to fishing, the industry of granite quarrying easily ranks second on Cape Ann. Around the entire Cape numerous quarries are located, and thousands of tons are annually shipped to the great cities of the East and West. The industry is continually growing. The supply of stone is practically inexhaustible, and the emigration to the Cape of numerous Swedes and Finns has caused the working

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force of quarrymen to be increased by a class of men at once quiet and diligent. Forty years ago the business was confined almost exclusively to the natives.

The immense breakwater at Rockport is not the first undertaking by the United States Government. In 1830, a like work was begun at what was known as Long Cove, and continued until 1841, when the appropriation was exhausted. Besides this structure, several minor breakwaters, or, more properly speaking, piers, have been erected at private expense, near the various granite companies' quarries. At Pigeon Cove, also, a lofty mass of stone has been raised. But these stone piers are small, and their advantages are utilized for the most part by those vessels connected with the granite business.

From 1885 to 1887, 128,000 tons of granite was deposited to form the big government breakwater and from that time until its completion about five million tons of granite were sunk, at a cost of \$1.15 per ton. The harbor thus enclosed is of more than 1,600 acres, with a depth of sixty feet of water. The work at Sandy Bay was confined to the Rockport Granite Company and the Pigeon Hill Granite Company. The piers of these companies are but a short distance apart and the quarries lie to the west of the piers, and are connected with them by railways. The Rockport Granite Company besides owning extensive property at Rockport, also own and operate valuable quarries and works on the western side of the Cape, at Bay View, where their fine building stone and beautiful monuments are cut. The Rockport quarries are the largest on the Cape, one of them a great, deep hole, near the main highway leading to Pigeon Cove, is more than a mile in circumference, and varies in depth from 50 to 250 feet. Rails are laid to every available place in the quarry, where are cars loaded with ton after ton of stone run down to the pier, where vessels wait to be loaded.

In building the breakwater the stone was conveyed by sailing sloops and scows to the place of deposit. These craft were loaded by steam derricks, and the scows had patent bottoms which by

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means of powerful levers were made to swing open when the occasion demanded. Their capacity was about 100 tons, and they were towed by a powerful steam tug. The sloops were unloaded by means of a derrick attached to the mast.

## CHAPTER VI.

DESOLATE APPEARANCE OF COLONIAL BURIAL GROUNDS.—EARLY  
BURIAL CUSTOMS.—VARIOUS KINDS OF TOMBSTONES.—  
GRAVE DIGGER'S FEES.—MODERN CEMETERIES.—  
OBITUARY INSCRIPTIONS ON MONUMENTS.

THE early settlers of the country, especially, the Puritan colonists, brought little of that refined sentiment which finds consolation in laying the remains of beloved ones in pleasant places, and adorning their graves with the beautiful of nature and art. Their austere religion paid little regard to such things, or rather forbade them. So that the gloomy aspect of the grave was more congenial and appropriate. They buried their dead with proper concern and due ceremonies, and often reared over their graves stones which recorded the virtues of the good, but there was no pathway to those graves worn by mourning friends; few went thither to protect the turf or to plant shrubs or flowers over them. When their dead were buried out of their sight they cherished their memories in the heart, but made no votive offering at the grave.

In some cases the early colonists selected elevated and grand sites for their burial places, which looked out upon the sea or over the abodes of the living. The old Winslow burial place at Marshfield, that at Plymonth, Cops Hill Burial Ground in Boston and some others are examples. But it was too often the case, if we can judge from the relative position of old burial grounds now, that they selected places neither secluded, beautiful nor picturesque. This is the more true of the successors of the first settlers, perhaps, than of the Pilgrims and their contemporaries. A piece of land was set aside for the "burying ground" rather for its convenience, the nature of the soil and such considerations. Though the primeval forests were about them, and space almost illimitable, they chose too often some contracted place where the woods were cleared, and sometimes in low and inappropriate situations.

The descendants of the Pilgrims and the Puritans are most responsible for the desolate and repulsive appearance and condi-

tion of these old cemeteries. They closely followed the bad example of their forefathers, without the redeeming qualities which the latter sometimes exhibited in the choice of sites. They continued to carry their dead to the old burial grounds, which they suffered to become more desolate and neglected than in their earlier days, until more room was required, and a new field—perhaps a little larger and even less attractive in its aspect—was selected, enclosed, and left unadorned and in a short time uncared for.

Thus it was for two hundred years in our older towns; they became more and more repulsive, inscriptions have been obliterated, stones broken or buried, or reset without regard to its rightful place, and each generation has seemed to vie with its predecessor in doing as little as possible for the embellishment, and even ordinary neatness and preservation of the grounds and their contents. Moreover, as the population increased and small villages grew to thriving towns and large densely inhabited cities, those burial grounds were in the midst of the habitation of the living, mere yards of graves and unsightly rows of charnel houses. Each year the burials became more numerous, and from this constant increase and the mode of burial, it at last was considered that such cemeteries in the midst of the living were prejudicial to health, as well as disagreeable to the eye. And so utility, necessity, finally accomplished what taste alone could not.

An infamous custom prevailed for years among some of the sextons in Boston, and may be of other localities, of speculating in tombs. Finding a poor widow, or dilapidated heir, having a share or factional interest in some old tomb under his care, the grave digger, aware of the absence or death of the principal owner, purchased it for a trifle, seized the whole by prescription, or threats of the law, called it his own, erased the family name, cleared out the sacred relics which lie there, and then made a trade by selling a berth for dead strangers in the city at eight, or ten, or twelve dollars apiece, as the case may be. This was done repeatedly in Cops' Hill, King's Chapel and other burial grounds in Boston. Nor was this all. After the tombs had been filled up by the remains of strangers, these corpses were carted out of town in the night, or buried in a hole dug in the bottom of the tomb, pounded down in one horrid hideous mass, and covered over to make room for more death money. If there is any doubt of the

facts here stated, let the records of the Probate Office in Boston be searched along in the 30s. It will then be seen how many sextons have left a legacy of tombs in their wills as a profitable investment to their heirs.

Soon after the settlement of Boston our fathers bethought themselves about a place of burial, and selected for that purpose the lot situated at the corner of Tremont and School streets, where the first burials in the town were made. But the exact date when it was set apart for this purpose has never been accurately determined. We know, however, from Governor Winthrop, that February 18, 1630, "Capt. Welden, a hopeful young gent and an experienced soldier, dyed at Charlestowne of a consumption, and was buried at Boston with a military funeral." In form the old King's Chapel Burial Ground, as the old burying-ground is now called, is almost square, and is situated very nearly in the centre of the peninsula, and adjoining the first granite building in this country, the King's Chapel. Its principal entrance is from Tremont street, through an iron gateway; although in School street at the south-easterly corner, near the City Hall lot, there is a way chiefly used as an approach to the twenty-one vaults beneath the chapel. Exclusive of these there are, including the charnel house, about twenty-nine tombs within the yard, making about one hundred connected with the cemetery. Twenty-two of these border upon Tremont street, twenty-four upon the easterly edge of the yard near the City Hall lot, and thirty-two with the charnel house are in the middle of the ground. The tombs on the Tremont street side were built in 1738, at the same time the old brick wall was erected; those on the easterly side being of a little earlier date (before 1715), while those in the area are the most ancient. The earliest fence enclosing the burial ground had its origin in the following order, passed 1642: "It is ordered that the constables shall, with all convenient speed, take care for fencing in the burial place." The old brick wall of 1738 remained standing until 1830, when it was removed and a fine hammered granite stone wall erected in its place. In 1854, the Quincy granite was removed and the present neat iron fence put up in its stead, in both cases the expense being chiefly defrayed by money obtained by subscription. By a vote of the town passed November 5, 1660, it was ordered "that it should be deserted for a convenient season and the new places appointed for burying made use of." At that time the then new cemeteries

—the North Burial Ground on Copps' Hill, and the South, more generally known as the Granary Burial Ground, on the westerly side of Tremont street near Park street, were laid out for use.

To a stranger who visits this old habitation of the dead, beside the most frequented street in the city, feelings of reverence are at once awakened; and the strange looking old stones with their quaint inscriptions idealize the past, as, winding along among these hallowed relics, one reads the brief history of a spent life in the simple name and age of the lone tenant beneath each of them, cut with the sculptor's chisel in the cold, gray slate. To the old Bostonian, associations of a dearer character rush through the mind, as the history of times long past involuntarily comes up, while perusing the names of the well-known active townsmen of the days that have passed away forever.

A walk through this silent habitation may not be wholly uninteresting. On passing the principal gateway of this sacred enclosure, the visitor is forcibly struck with the peculiar arrangement of the gravestones which first meets his eye. He notices rows of these memorials of the deceased lining all the avenues and bypaths of the ground arranged as fences—the curious freak of a noted superintendent of burials, who removed these testimonials of love and respect from the spot where they had been placed in pious memory of deceased relatives and friends—so that they now serve only as a record of the past, without giving the hallowed associations for which they were originally raised.

When our forefathers crossed the ocean and settled in this country, it was not long before the tombstone cutter made his appearance, and with his wagon load of slate and marble slabs, he journeyed through the towns, and when he sold one, he put up his horses and proceeded to letter the stone on the spot; and when he had finished and set the job, he started on in quest of another victim.

The most ancient of these memorials are constructed of a very durable species of stone—porphyritic green stone—smoothed on one or two faces, and bear inscriptions in plain Roman capitals; although in the oldest, some of the letters are blended together as logotypes; and they are destitute of all sepulchral ornaments and devices whatever. The second in order of time were imported from Wales, are of very substantial slate stone, and they are often to be told by lines of color crossing the slabs. They are

enriched with sculptured borders, and decorated with death's heads, crosses, trees, hour glasses and cherubims. The gravestones next in antiquity are of home origin and are constructed of American marble or slate, having frequently rude carvings. Not infrequently will be found a more costly marble, from a foreign quarry, but shaped and lettered in this country. The tombs in the middle are designated by horizontal monumental slabs, supported either by columns or by solid rectangular constructions of brick or stone; while those on the sides of the enclosure generally have square tablets, resting upon the soil which covers the tombs. Some of these slabs and tablets exhibit well-cut armorial devices. The oldest slabs are of sandstone, and consequently, from the effect of the pelting rain and hailstones on their soft and perishable faces, their inscriptions have become somewhat illegible, if not altogether obliterated. The old native greenstone and the English slate stone have best performed their allotted task. Too many of the old stones have been removed from their proper places and used for covering drains, paving the floors of tombs and closing their mouths.

None of the cemeteries in Boston possesses more interest than does that at the North End known as Copp's Hill Burial Ground. Within a few years many avenues and bypaths have been laid out, gravestones having been removed for this purpose, affording opportunities for pleasant promenades, which were by no means neglected. The effects of the same busy hands, which so ridiculously arranged, or rather, disarranged the gravestones in the Chapel Burying Ground, are also visible in Cops' Hill; and perhaps the same mischievous hand which altered the date on the gravestone of Mr. John Thwing in the former burial enclosure, so as to have it appear that he died on the sixth of September, 1620, three months before the Pilgrims landed at Plymouth, instead of 1690, may also have perpetrated the same folly upon the memorial stone erected to the memory of goodwife Grace Berry, who died on May 17, 1695, and not in 1625, more than five years before the settlement of Boston, as the rude jackknife sculptor would make the unwary believe. This sacrilegious act is not peculiar to the Boston graveyards; in the venerable old cemetery upon Burial Hill in Plymouth, where so many of the forefathers of New England repose, and in the old graveyard in Charlestown similar ruthless hands have also been mischievously busy. During the seige of

Boston, in the early days of the Revolutionary war, the British soldiers amused themselves by firing bullets against the grave-stones, many proofs of which can be seen at the present day. Here may be seen tablets carved in a very excellent manner.

Perhaps the most noticeable monument in the Granary Burial Ground is raised over the tomb in which repose the parents and other relatives of Benjamin Franklin. It was erected in 1827, by a few citizens of Boston, to render more conspicuous a much revered spot. The obelisk is constructed of five ashlar of Quincy granite taken from the Bunker Hill quarry, and is twenty-two feet in height, and stands upon a rectangular base two feet high, and measuring seven feet on each of its four sides. On the easterly side of the monument the name of Franklin is cut in bold relief in large letters, and a short space beneath this is a bronze tablet, about thirty-two inches long, and sixteen wide, set into the stone, and containing the original inscription composed by Franklin with an additional subscription by the liberal citizens who paid for the monument. The original tablet placed on the tomb of Franklin was laid beneath the obelisk.

Heraldic devices, most excellently cut in English slatestone, are very numerous here, but monuments, if the horizontal tombstones are excepted, are very rare.

The weathering of the stone in these old places is noteworthy. The Welsh slates, some of which have stood nearly two hundred and fifty years, are often almost unaltered. The greenstone tombs have also stood the weather well. On a slate slab on Copps' Hill, having alternations of sandy layers parallel to the surface of the slab, one of these sandy layers has been eaten out, leaving the unsupported thin layer of slate to cave in; the slates are occasionally cleaned by the weather. The red and yellow sandstone, when standing upright, have almost always crumbled or scaled off, and the marbles have suffered. One case of this is a vertical slab at Copps' Hill about seventy years old, of a coarse marble; below the ground it retains largely its original smoothness, but above the ground, on the north-east exposure, the action of the rain and atmosphere has dissolved out the cement of the grains of the marble, leaving the isolated grains sticking out like sandpaper; on the sheltered side there is a marked difference. Another large imported marble monument, some one hundred years old, has weathered so that the shells embedded in the marble stand out in relief, and the stone is covered

with fine cracks, which, widening and admitting the black soot from the air, gives it a peculiar appearance.

In the Central or Old South Burial Ground on the Common may be found the remains of British soldiers who died in the barracks on the Common. It was also used for the burial of strangers and Roman Catholics, for the gravestones denote that fact sufficiently well, the graves of persons from foreign countries, even from China and from many of the New England States being designated by conspicuous memorials. The square and compass, emblematic of the mystic art, are more frequently found here than in the other burial grounds in Boston, and in one marked instance the cross or crucifixion is found with the Masonic emblems. There are but four monuments here, two of them of upright pieces of marble which have in the dim twilight of bygone days been shunned by errant youngsters as goblins of times long past.

Perhaps the first granite used as tombstones in Boston may be found in the South Burying Ground on Washington street, between Newton and Concord streets, and opened in 1810. The wall on Washington street is of hammered granite.

In its earlier days it was the scene of many of the capital executions, for near its most easterly part, which formerly extended to tidewater, stood the gallows, and the culprits were usually buried in deep graves within the cemetery near the place of their execution. In 1827, tombs were first built at the four sides of the yard until the number increased to one hundred and sixty-two, but they have long since been discontinued. The gravestones are not numerous, and strictly speaking there are no monumnetal inscriptions within it, although there are several granite structures standing upon vaults in the central part of several of the squares and at their corners.

The old cemetery at Charlestown was laid out about 1648, and contains one of the first granite obelisks erected in New England. It is 15 feet high, 4 feet square at the base and 2 feet at top. This was erected in 1828 by the alumni of Harvard College, in memory of John Harvard. But the exact location of his grave is unknown. Other stones are interesting because of the curious carvings upon them. Prominent among these is the stone of Sargent Richard Kettell, who died at the age of seventy-one, in the year 1680. It has an hour glass placed between two wings. Beneath is a skull flanked by two coffins, and a little lower two hour glasses. Beyond these are,

on the left, a package and a spade, and on the right a scythe, and last of all, on each side the cross bones. In addition to these Masonic emblems are three Latin mottoes. The whole is executed with clearness and beauty, and with great attention to detail.

The oldest marked grave in New England is that of Bernard Capen in the Old Dorchester Burying Ground at Uphams Corner, where the first stone flagging laid down to keep the wolves away is still in evidence to prove its claim. This lies not far from the beautiful Stoughton sarcophagus restored by Harvard College. Capen died November 8, 1638, aged 76 years, and his wife, Joan, died March 26, 1653, aged 75 years. This burying ground opened in 1634, was the first public cemetery laid out by vote of any town in New England.

It was the custom in the early Colonial days to make the graves due east and west, and the body was placed in the grave with feet to the east. This custom was the remnant of an old belief that at the Judgment Day the dead would rise in the same form in which they had been laid in the grave. The belief was that on the last day the Judge would appear in the eastern sky on a great white throne, and at the sound of the trumpet the graves would open and the dead come forth in the same mortal form which they possessed at death. Therefore, by being buried with feet to the east the body when it rose should come upon its feet facing the great throne, and then stand erect and motionless until it had been judged and sentence passed upon it.

It was also a custom when the burial ground was first prepared to appoint some prominent place in the ground for the burial of persons connected with the management of public affairs, and this place extended north and south, so that the graves made in it should extend east and west. The magnates were buried in this place side by side, and with feet to the east in the same manner as others were buried. This was done in the belief that at the Judgment Day, those officials should rise together, standing side by side, and would be judged collectively upon their official acts, as well as individually upon their private characters.

The old beliefs have passed away, and since burial grounds have been divided into family lots—which is within very few years—graves have been made any position as most convenient, and yet go where you will it will be found that a strong feeling predominates in favor of the east and west position, and this

undoubtedly without any knowledge of the origin of the old customs, and simply as a survival after the belief in which the customs originated has ceased to exist.

Another old custom in connection with the burial of the dead has continued long after the belief in which it originated has passed away. This, however, is not altogether a survival from the force of habit. Convenience has also greatly assisted to preserve it. This is the custom of carrying the dead feet first. This originated when it was believed that the spirit of the dead would seek to return to the place where the living person had resided, and the corpse was carried feet first in the belief it could not see the door through which it had been taken out, nor the route along which it had been carried to the grave.

April 15, 1741, Thomas Moulin, John Chambers and Nathaniel Band were appointed by the town of Boston to be grave diggers at the Old and South Burying Grounds, and were given the following instructions:

1. "That one of the said three persons, with one assistant at the least, do always attend the funeral of every white person at the gate of the burying place to conduct the corpse to the grave and to see the same covered up.

2. "That the gates of the burying place be kept constantly locked, excepting at such times as they are opened to receive the corpse, and in the winter time, that the passage to the burying places, and to the graves be kept clear of snow, and that in digging the graves they so perform it as that the top of the coffins be three feet under ground at least.

3. "That they take care that the By-Laws of the Town made July 29, 1723, respecting the burial of negroes, be strictly observed, and that they acquaint the persons by whom they are employed to dig the graves for, and carry the corpse, of the By-Laws of the Town made in 1701, that the time for carrying out the corpse shall not exceed one hour from the tolling of the second bell, upon penalty of 20 shillings.

4. "That the prices for opening tombs and digging graves be as follows: For digging a grave for a white person, man or woman, nine shillings. For ditto for children carried by hand, four shillings. For ditto for a negro man or woman, six shillings. For ditto, to twelve years of age, five shillings. For opening the old tombs, or those that stand in the midst of the burying places, four-

teen shillings. For carrying the corpse of a grown person, and attendance from eleven o'clock in the forenoon, to the return from the grave, five shillings apiece."

The late Abram English Brown, in his book, "Beneath Old Roof Trees," has an interesting chapter entitled "Old Burial Ground at Bedford, Mass," in which he says: "When but a child, I found something congenial to my taste in the habits of an old man whom the townspeople familiarly called Uncle Leander. I had seen him on several occasions with a pail of whitewash and a brush in hand, passing about among the leaning slabs, and here and there applying his liquid coating.

"I was quite sure that some wise purpose actuated him in his repeated visits to this sacred enclosure. My resolve to inquire into this particular work was often or no avail, because of my failing courage when I neared the gate whose slabs I had so often heard flopping in the breeze. In fact I had an early aversion for the ancient sepulchre, because of false stories told me of the rude designs there seen on many stones. But the results of the old man's work recommended his acts to me, and I at length mustered courage to interview him. \* \* \*

"'This preparation of lime,' said he, 'prevents the moss from gathering and keeps the epitaphs in a legible condition.' " He then relates how Uncle Leander had adopted this method of marking the graves of the soldiers of the Revolution many years before and organization had sprung up to do it. The whitewashed slabs throughout that enclosure indicated the resting-place of a good share of the seventy-seven men from Bedford who were seen in Concord in the hottest of the fight.

It was only necessary that the first step should be taken in order to secure a reform in the character of our cemeteries. When Mount Auburn was laid out (it owing its origin to Dr. Jacob Bigelow of Boston)—a beautiful example of what the resting-place of the dead should be—communities as well as individuals became sensible of the defects and insufficiency of the common burial grounds. Similar cemeteries were soon after established in the vicinity of other large cities in the country, and these in turn exerted a good influence, so that rural cemeteries were next established in or near towns of less magnitude, and public sentiment began to demand that the old burial places should be better cared for and, at least, rendered less repulsive. There were, indeed, but very few spots

used for burial, before the establishment of Mount Auburn, which gave evidence of good taste and a proper regard for the dead. But most of the cemeteries which now make any pretence to rural embellishment have been established since the consecration of Mount Auburn, and are in no small measure the result of the influence of such an example on public sentiment. From that time rural and garden cemeteries have been increasing in numbers, and a refined taste in regard to this subject has been extended.

Forest Hills Cemetery is believed to be the first one of the kind established by any city or town, in New England at least, as the public burial place of its inhabitants. It cannot be said that it was established exclusively for the use of the inhabitants of Roxbury. Its proximity to Boston and a large suburban population was duly considered in its establishment, and it was designed to meet in some degree the wants of these, as well as the municipality by which it was established, but which soon after became a part of Boston.

Though we call this improvement in public sentiment a progress of later years, it cannot be claimed as an idea of this enlightened age. It is rather a return to the practice of former times, the revival of old ideas, the learning of a lesson from the ancients and from the heathen, but improved by the spirit of Christianity and the refinement of modern times, but more than all, it is the expression of feelings natural to the human heart.

Mount Auburn, which was consecrated in September, 1831, is a private establishment, projected and controlled by individuals. It has a silent population of about 40,000 persons within its area of 140 acres. This certainly is a famous spot, and contains the dust of probably more famous persons, preachers, actors and actresses, writers and scientists than any cemetery in the country.

The first gate at this cemetery was constructed of wood, but rough cast in imitation of stone. In 1843, the portal was reconstructed of Quincy granite, after the same design and in the same style of architecture—the Egyptian—and it presents to the eye of the beholder an imposing structure, whose very massiveness and complete workmanship insures a duration to be measured by ages. It is less heavy, however, than the common examples of that style, and its piers have not the pyramidal in sloping form so common in Egyptian edifices, but are vertically erect in imitation, essentially, of the gateways of Thebes and Denderah. The massive

cornice by which it is surmounted is of a single stone measuring 24 feet in height and 12 feet in breadth. When it was quarried its weight approximated 125 tons, but this was reduced about two-thirds when shaping it. When finished it was raised to its place as the completing feature of that impressive entrance to the "City of the Dead," by hoisting jacks, and carried upon blocks to the level required above the grade around the gateway. The ponderous lental beneath the cap was raised in a like manner. The principal contractor for the construction of the gateway was Joseph W. Coburn, a former pupil of Gridley Bryant. The granite was furnished by Joseph B. Whitcher and cost \$10,000.

Forest Hills has been termed by many as the finest cemetery in New England. It was first opened in 1848, and since that time its original territory has been added to until it now covers an area of over 200 acres of land in the West Roxbury (Boston) district. It is a veritable "City of the Dead," but the entire character of the place is such that it seems more in the nature of a large pleasure park than a place of burial. The finely graded walks, shady paths and romantic corners with which it abounds seems to chisel off much of the sharpness of the pain of those who have loved ones there, and to help them look upon the place as a pleasant home.

In the recent cemeteries of the country there has been an immense consumption of stone for monuments and curbing, and for these purposes granite is king. Rarely is a monument placed in any of these homes of the dead cut from any other stone, for experience has shown that it is the only suitable material that has yet been found for the purpose suited to the New England climate. This condition has been brought about by the introduction and perfecting of machinery for cutting and handling the stone, and the skill of man in handling these new appliances. No matter how huge or how delicate the work, it is turned out in a matter-of-fact business way that would astonish the old-time stonecutter.

Perhaps the first real impetus to this industry was given when granite polishing was introduced, for the first of these of Quincy granite erected in the modern cemeteries were of polished pieces. Later came the other granites, particularly those from Barre, Vermont, Westerly, Rhode Island, Milford and Concord, New Hampshire, Rockport, Massachusetts, and Hallowell, Maine. Polished red granite monuments from Scotland, New Brunswick and Maine are plentiful. Both yellow and red sandstone have been

used, and in some instances, like that of the Winter monument, soapstone is the material.

The weather shows its effects on the monuments in these cemeteries in a remarkable manner. Some of the old tombs have the roughened surface (by solution of the lime); others, however, have stood as long without the same evidence of changes, especially the fine-grained marble. In one tomb of a medium coarse white marble, in Mount Auburn, in a course at the top of the structure, the marble has disintegrated as follows: on the corner pieces and sides the marble cracks almost imperceptibly; along these cracks the cement of the grains (or some of the grains) is slowly dissolving out, leaving the coarse grains, and these finally crumble off in powder. As this continues, whole lumps are loosened and fall off, breaking into powder; in this way one of the corners has entirely crumbled to loose grains which may be taken up by the handful. The tombs and monuments made of the different granites have been slightly affected by the weather, principally by changing their color. The diabase tombs have turned a rusty brown, the change apparently occurring in the black minerals, while the feldspar whitens. Many of the sandstone tombs have expiated considerably; there is one curious case of a large tomb of this stone in which ivy had been trained up the face of the stone, but the continual peeling off of the layers afforded the tendrils no support. In one tomb in Woodlawn cemetery there is the combination of Vinal Haven red, Spruce Head white, and black granite, all from Maine.

But to some persons the shape, the size, the color, and the workmanship upon these old stones are less interesting than what we find inscribed thereon. Anyone that has looked far into this uncanny subject will see that inscriptions have changed quite as much in the lapse of years as the stones themselves. Those of a century or more ago bear infallible testimony to the dark and sombre teachings of the theology. The more enlightened and liberal and hopeful view of the things that pertain to God and the future life, held at the present day, is more fittingly represented by memorials that depart from the gloomy. The change from dark stone to light approximately marks the progress of theological thought from the dismal view of the early period in the history of our country to the happier ideas of the present day.

The obituary poetry of the ancient time often discloses the fact

that the religion of the day held over the living a sword of Damocles in the form of a constant vision of death. But we must suppose that it came from the deeper recesses of the heart, and if not always constructed with due obedience to the rules of rhythm, and not always felicitous in thought, showed all the plainer the struggle of the writer to give expression to the feelings of resignation, hope, warning or affection which were uppermost in his heart.

It was the custom a century ago, in case of the death of a man of uncommon prominence, to inscribe upon his gravestone the leading traits of his character, a work that is now done in newspaper obituaries. The following illustrates one of these forms, and is a good example of obituary building, besides introducing a scriptural quotation.

#### MOTTO.

The Lord is good to the soul that seeks him.  
Here lies what was mortal of Capt. Thomas Jones  
who departed this Life Aug't 3d 1784. Being 72  
years of age.  
Capt. Jones was a gent of unspotted character of  
a hospitable mind & practice courteous & free to  
all the poor. He did not look with con-  
tempt but pity and relief never sounding  
a trumpet over his charity. As a christian  
he ever esteemed that conversation best that  
savor'd most of heavenly things. In domestic life  
he was one of ye most kindest of husbands and con-  
stant instructing his children & servants into ye  
knowledge of ye best things respecting life &  
goodness in an evident proof of his being a loving  
father & a good master. As a neighbor he ob-  
tained a good report. The duty of his military  
trust he discharged with fidelity and honor and  
is now no doubt receiving the reward of grace.  
Let us look upon his example and do likewise.

Though the women of those days were regarded as subordinate in the family, and in many cases were referred to upon tombstones as "relics" of Mr. So and So, they were sometimes accorded equal respect and honor with the husband. The words "Memento mori," "Here lies the remains of," "Here lies interred the body of," "Here lies buried" and "Here lies the mortal part of," were frequently employed as the opening words of the story upon the tombstone. Another common form of expression was "Sacred to the memory of," a tender and beautiful thought to embody in the memorial to a loved one.

As a fair example of gravestone poetry which illustrates not only the theology of a century ago, but the business morality as well, "Though he promised to his loss he made his promise good," is a motto that well might be adopted by business men today.

### MEMENTO MORI

Here lye interred  
the remains of  
Mr. John Lee who departed this life Feby 7th, A. D. 1761,  
aged 43 years and 49 days

### MOTTO.

"Who to his plighted vows and trust  
"Had ever firmly stood  
"And though he promised to his loss  
"He made his promise good.

Whoe'er thou art who walks this Burrying place  
Here turn your eyes, come look, abate thy pace,  
Time was when I like thee a Life possess'd  
Once men we loved, we valued and carress'd  
But now Nought but a heap of dust remains  
And you like me must yield unto Deaths claims  
But mark before thou yieldst and one word take  
Be warned, Repent, thy soul, thy alls at stake.  
In midst of great prosperity remember now that thou must die.

There has been a gradual departure from the old style of inscription as well as from the old form and color of headstones, to that of the most modern which tells in brief words the name, the year of birth and that of death. Brevity like this is often seen:

John Jones,  
1821—1892.

But before that was reached there were intermediate steps. The old forms of expression like "Here lies the body of" were gradually discarded and only the name of the deceased with the date of his birth and death would appear, with sometimes a verse of poetry, but more often a quotation from scripture.

The attempt of the inner nature of the afflicted stirred to its very secret sources of suffering and loss, to express itself, was visible upon the stones of a century and a half ago in the poetry and obituaries. But it is not absent in another form on many stones erected today. It appears in the tender word "Mother," standing by itself on the headstone or marker, and opening a fountain of tenderness in every heart; in the word "Father," with all it implies of protection and affection; in the words "Wife," "Husband," "Baby," and in familiar names known in the household as John, Mary, Samuel, Ann. These names that meant so much in the

family—many of which are so full of significance in every family—are placed conspicuously upon one side of the stone, while upon the other is chiseled the name with date of birth and death, or, if a family lot has a monument, these facts are cut upon that.

The obituary has almost wholly departed and the interest in visiting the modern cemetery is found principally in seeing the beautiful monuments. Now the inscriptions are often little more than a catalogue of names and dates, a mere necrology. A search of several hours in Mount Auburn brought to light but two comparatively recent inscriptions that tell much about the deceased. These are upon a low block of Scotch granite and read as follows:

Pelig Sprague, eminent as a statesman, lawyer and judge, conspicuous for strength, purity and nobility of character, for many years a sufferer by painful illness, yet ever firm, patient, cheerful the wise and sympathetic counsellor, the unfailing guide to all

This occupies the right half of the front of the stone, while upon the other half is cut this tribute:

Sarah, beloved wife of Pelig Sprague, and for sixty-three years his devoted companion and helpmate; gentle without timidity, guileless but discerning; a tender mother, a devoted Christian, her long life was full of self-sacrifice and devotion to others.

In this case the dates of the birth and death of the worthy pair are given on markers under which their dust repose.

From twenty-five to fifty years ago it was more common than now, though the practice is far from obsolete, to quote scripture upon the headstone that might be especially significant of the character or life of the deceased. Here is a case in point, both names appearing upon the same stone:

Robert B. Williams.  
Born, May 25, 1792.  
Died, April 5, 1872.

"Mark the perfect man and behold the upright, for the end of that man is peace."

Hannah Stone,  
Wife of  
Robert B. Williams.  
Born, October 30, 1801.  
Died June 7, 1869.

"Her life was hid with Christ in God."

Other expressions somewhat common were:

"Until the day break and the shadows flee away."

"Kept by the power of God."

"He giveth His beloved sleep."

"Until day break."

"Say not good night, but in some bright and fairer clime bid me good morning."

"She wears a crown."

"God's providence over all."

"I know that my Redeemer liveth."

The poetry of this latter period is in rhythm better, and filled with messages of joy, peace and hope. Here is a quotation from a stone erected since 1879:

There is no such thing as death—  
In nature nothing dies.  
From each sad remnant of decay  
Some form of life arise.

Sometimes the poetry rises to even sublime heights, and our hearts are inspired by the uplifting thoughts. Can anybody read this expression of immortal hope that appears upon the stone of Mary, the wife of the youth of Edwin Booth, the actor, without having his belief in immortality deepened?

The handful here that once was Mary's earth,  
Held while it breathed so beautiful a soul,  
And when she died all recognized her birth  
And had their sorrow in serene control.  
"Not here! Not here!" to every mourner's heart,  
The wintry wind seemed whispering round her bier,  
And when the tomb-door opened, with a start  
We heard it echoed from within "Not here!"

Some forty years ago the long slender shaft of sandstone, with perhaps an urn on the top, or a draped female figure were in high favor. Afterwards came a type consisting principally of an oblong block of colored marble or granite (often polished) set upon a pedestal. It gives an idea of strength, solidity and stability that the lighter forms cannot give. Unpolished Tennessee marble was popular for a while but granite soon displaced it.

## CHAPTER VII.

BETTER SOCIAL CONDITIONS AND HIGHER WAGES.—QUARRIES,  
THEIR OWNERS, LOCATIONS AND DATE OF OPENING.—VALUE  
OF GRANITE IN THE ROUGH AND MANUFACTURED.

**C**ONTRASTING the present with the past we find that instead of a few industries struggling for existence, every kind of manufacturing industry covering a wide range of products formerly unknown but now deemed essential to the comfort and convenience of man well established. The multiplication of industries has broadened the avenues of employment, and their subdivision has given employment for the exercise of special skill and talent, while the method of conducting the industries has immensely increased the productive capacity of the workmen, cheapening the product to the consumer while giving him a vastly superior article, and giving the employee a larger wage. Machinery of every kind has come to the assistance of the workman especially in the granite business, thus creating new and wider channels of industry. Under the new system working time has been reduced from 12 to 33 per cent.

The household comforts, educational advantages, and conveniences possessed by the mechanic today are so far beyond what the workingman had, say a century ago, that the difference in scale of living between the employer class and the laborer of the early period was far less than that between the workman of today and his predecessor.

The improvement in internal communication—railroad, telegraph and telephone—bind together industrial communities widely separated geographically, enabling the mechanic to quickly and cheaply seek new localities if deprived of employment in any one particular place, permitting workmen to unite in a common effort to better their condition, while adding to the certainty and security of industrial operations.

As a rule, wages show an upward tendency from the earliest recorded period to the present time, the progress being broken at certain intervals, as relates to certain industries, by fluctuations,

temporary only, and, therefore, not materially affecting the onward current. For the period ending with 1860 but three occupations, bookbinders, metal workers, stone cutters and quarrymen, show a decrease as compared with the previous decade, and in all instances the decrease is very light. From this it appears that during these periods of business depression the nominal rates of wages were but slightly reduced, although the aggregate earnings of wage workers may have been considerably diminished on account of reductions in working time.

The wants of man constantly tend to exceed the fulfilment of his desires, and thus there will always be a labor question while human nature remains. The condition of the workingman today is not an ideal one, but that so much advance has been made that it is constantly easier to secure respectful attention to, and, finally, just action upon the claims of labor, is, of itself, an index of progress. In the heat of discussion what has been accomplished is often forgotten. Whatever changes the future may bring in the industrial organization, the tendency is upward toward better social condition, not downward, as is sometimes assumed. In this upward trend lies labor's hope.

The daily wages of stonecutters and quarrymen from 1836 to 1883 were as follows: 1836, cutters, \$1.43; 1839, \$1.32; quarrymen, \$1.03. 1840, cutters, \$1.49; quarrymen, \$1.20. 1845, cutters (high), \$1.60; (low), \$1.47; firemen, \$1.41; quarrymen, \$1.19. 1850, cutters (high), 1.74; (low), \$1.64; quarrymen, \$1.10. 1854, hammerers, \$1.75; quarrymen, \$1.21. 1855, cutters, \$1.88; firemen, \$1.75; quarrymen, \$1.19. The average daily wage paid to these mechanics from 1831 to 1840 was \$1.29; 1841 to 1850, \$1.45; 1851 to 1860, \$1.40; 1861 to 1880, \$2.33; 1881 to 1883, \$2.01. This shows a general average wage from 1840 to 1880 of \$1.70.

The rates of wages in 1902 were somewhat lower for stone quarrymen than for all other minerals combined, the former having been from \$1.00 to \$2.24, while the total of all other mineral workers received between \$1.00 and \$2.74 per day. There were about 50,000 men employed in the United States as quarrymen and stonecutters and 95 per cent. of these received between \$1.00 and \$3.24 per day. The total number of engineers employed was 2,540, the range of wages for 80 per cent. of them being from \$1.50 to \$2.74 per day. There were 933 firemen reported, 83 per cent. of whom received between \$1.25 and \$2.24 per day. Of the 2,780 machinists

and other mechanics, 94 per cent. were paid from \$1.25 to \$3.24 per day.

The increase in the number of quarries was 561 from 1880 to 1889, and 32 from 1889 to 1902. This difference in percentage of increase is due partly to the tendency towards combination. The value of the product of these quarries increased \$9,275,097 from 1880 to 1889, and \$3,793,849 from 1889 to 1902. There were 313 quarries reported idle in 1902. The average number of wage earners employed in quarries in the United States during last month in 1902 were: January, 12,442; February, 12,828; March, 14,933; April, 18,882; May, 20,350; June, 21,589; July, 22,678; August, 22,843; September, 22,331; October, 22,019; November, 19,342; December, 15,789. The variation in the number employed during the summer and winter months is readily explained when it is remembered that quarrying is an outdoor pursuit and the severity of the northern winters interferes to some extent with all outside work.

The values of all kinds of stone increased and decreased alternately from 1891 to the close of 1895, and there was a further decrease in 1896 when the lowest value was reported. Since 1896 there has been a steady increase. A decline in granite, limestone and sandstone begun in 1891, but the return to more prosperous conditions began in 1897, and by 1902 the earlier output had been equalled or exceeded for all classes.

The production of granite ranked by value of product in New England was: 1880, Massachusetts, \$1,329,315; 1889, \$2,503,503; 1902, \$3,451,397. Maine, 1880, \$1,175,286; 1889, \$2,225,839; 1902, \$2,659,450. Rhode Island, 1880, \$623,000; 1889 (fifth rank), \$931,216; 1902 (tenth rank), \$734,623. Vermont, 1880 (thirteenth rank), \$59,675; 1889 (ninth rank), \$581,870; 1902 (third rank), \$1,570,423. New Hampshire, 1880 (sixth rank), \$303,066; 1889 (seventh rank), \$727,531; 1902 (fourth rank), \$1,147,097. Connecticut, 1880 (fourth rank), \$407,225; 1889 (fourth rank), \$1,061,202; 1902 (seventh rank), \$812,141. Massachusetts and Maine occupied in 1902 the same relative position as they held in the tenth and eleventh census, while Vermont advanced from the ninth to the third and New Hampshire from the seventh to the fourth. The changes in rank are due in some cases to a decrease in production, and in others to an increase.

The granite produced in the United States in 1911 had a value of \$21,391,878, an increase of \$849,911 over that of 1910.

Fourteen States produced granite valued at more than \$500,000 each and six of the 14—Vermont, Massachusetts, California, Washington, Rhode Island and Connecticut—showed a good increase from the year before.

In paving blocks there was an increase of 1,029,704 from 1910, when the production was 57,089,399, and an increase of \$36,059 in value.

The value of the output of trap rock—used largely in macadamized road building and in reinforced concrete construction—was \$6,399,622, a decrease of \$52,519. Massachusetts and California only showed an increase.

The United States Census for 1880 gives the following list of quarries, their owners, location and date of opening for New England:

MASSACHUSETTS. Gloucester—Stephen B. Andrews, 1876; Cape Ann Granite Company, 1899; Trumble Granite Company, 1879; Solomon Trumble, 1879; John Butman, 1853; Barker Brothers, 1851; Vernon Brothers, 1878. Rockport—Rockport Granite Company, 1830; Pigeon Hill Granite Company, 1870. Lynn—J. R. Jordan, 1850; J. D. Wilson, 1860. Peabody—Samuel Brown, 1841; Putnam & Linnehan, 1872; Scott Brothers, 1861; H. H. Newhall, 1871. Lynnfield—Thomas R. Newhall, 1870; T. J. Newhall, 1861. West Andover—J. Maddox, 1879. Lawrence—Jesse Moulton, 1847. Lowell—S. L. Ward, 1876. Medford—Town of Medford, 1872. Monson—W. L. Flynt & Co., 1878. Brighton—S. W. Brown, Jr., 1850. Dedham—M. Bullard, 1870; John Delaney, 1868. Sharon—John Moyle, 1874. Randolph—Nicholas White, 1871. Brockton—W. T. Cleveland, 1879. Fall River—William Beatty, 1840; Nathaniel Thurston, 1873. Freetown—Fall River Granite Company, 1874. Ashland—Judson W. Cole, 1874. Framingham—J. G. Cloyse, 1851. Westford—Andrew Fletcher, 1880; Prescott & Son, 1850; David Reed, 1854; Swett & Smith, 1845; Sol. Spaulding, 1847; Benjamin Palmer & Sons, 1847; William Reed, 1847; Samuel Fletcher, 1847. Ayer—Samuel Fletcher, 1877. Fitchburg—S. P. Litchfield, 1831; Fred Hale, 1876. Leominster—S. L. Kittredge, 1872. Clinton—L. M. Allen, 1875. Worcester—G. D. Webb, 1830; B. Converse, 1870. Milford—Richard Carroll, 1869. Northbridge—Diamond Hill Granite Company, 1855; Samuel Fowler, Jr., 1869; George Blanchard, 1865. Charlton—Lampson & Woodbury, 1864; Stone & Hiscox, 1879. Northfield—Bassett & Lyons, 1875. Deerfield—Westcott

& Ames, 1880; J. G. Noakes, 1871. Pittsfield—E. L. Humphrey, 1880. Becket—McClellan & Goodwin, 1878; Chester Granite Company, 1839; S. B. Corliss, 1872. Brockton—W. T. Cleveland, 1879. Fall River—William Beatty, 1840; Nathaniel Thurston, 1873. Free-town—Fall River Granite Company, 1874. (For list of Quincy firms see another page.)

RHODE ISLAND. Pascoag—Garvey Brothers, 1873. Woonsocket—Fairmont Farm Company, 1859. Diamond Hill—Diamond Hill Granite Company, 1840. Smithfield—Smithfield Granite Company, 1871. Cranston—Richard Fenner, 1820. West Greenwich—Horace Vaughn, 1865; Joseph Tarbox, 1863; James Ray, 1877. Newport—J. S. Stacey, 1855. Westerly—Charles P. Chapman, 1862; New England Granite Works, 1850; Smith Granite Company, 1843; Charles P. Chapman, 1874; John R. Macomber, 1860; R. L. Means, 1879. Niantic—A. G. Crumb & Co., 1859.

NEW HAMPSHIRE. Plymouth—Jarvis Sanborn, 1870. Lebanon—Charles Freeman, 1865; P. H. Freets & Son, 1844. Hanover—David L. Tilton, 1870. Rumney—G. D. Kenaston, 1870. Sunapee—Charles E. Boyce, 1846. West Concord—Putney & Nutting, 1851; Crowley & Quinn, 1866; George A. Bosworth, 1870. Concord—Donagan & Davis, 1866; Abijah Hollis, 1865; Harrison Granite Company, 1875; M. H. Johnson, 1879; Francis Hodgman, 1874; Fuller & Pressy, 1867; Granite Railway Company, 1862. Allentown—Charles A. Bailey, 1876. Durham—Joseph H. Abbott, 1871. Raymond—Harris F. Keys, 1850. Peterboro—Denis O'Keefe, 1850. Milford—Kittredge & Carlton, 1877; Everett & Hutchingson, 1871; Thomas King, 1871; Nathan Merrill, 1874; George F. Parker, 1870; L. M. Burns, 1820; A. D. Bates, 1865. Mason—James Maxwell, 1875; William Braman, 1860; Alexander McDonald, 1869. Nashua—C. W. Stevens, 1822; Manchester, Amoskeag Manufacturing Company, 1873. Fitzwilliam—D. H. Read, 1864; R. L. Angier & Co., 1864; Melvin Wilson, 1860; Ethan Blodgett, 1868; John E. Fisher, 1879; Albert Hayden, 1870. Marlborough—Albert G. Mann, 1812. (For additional Concord and Milford firms see another page.)

VERMONT. Brunswick—St. Johnsbury Granite Company, 1854. Morgan—D. T. Turner & Son, 1870. Ryegate—R. F. Carter, 1875; R. W. Laird, 1850. Woodbury—C. W. Cilley, 1880; J. Ainsworth, 1876; Voodry & Towne, 1879. Barre—E. L. Smith, 1835; G. W. Mann, 1878; Wetmore & Morse, 1840. Bethel—Edwin Kittredge, 1868; E. Sturtevant, 1879.



CHARLES TONELLA

*Firm of Tonella & Sons, Milford, N. H.*



\*VIEW OF TONELLA & SONS' QUARRY, MILFORD, N. H.



CUT BY CONTI BROTHERS, MILFORD, N. H.



CUT BY MACCHI & Co., MILFORD, N. H.



CUT BY BURNETT BROTHERS, MILFORD, N. H.



CUT BY P. C. FELLI & CO., MILFORD, N. H.



CUT BY NEW WESTERLY GRANITE COMPANY, MILFORD, N. H.

**CONNECTICUT.** East Killingly—Joseph Oatley, 1842. Sterling—J. W. Boswell, 1877; Samuel Townsend, 1875; Oneco Ledge Company, 1855; Willimantic—Alanson Humphrey, 1875. Bolton—Bolton Quarry Company, 1805. Glastonbury—Chester Hentze, 1850. West Norfolk—Snow & Wooster, 1873. Thomaston—Plymouth Granite Company, 1855. Roxbury—E. Mower, 1873. Greenwich—John Voorhis, 1835; S. D. Hill, 1830; William Ritch, 1850; Thomas Ritch, 1850. North Bridgeport—Wheeler Beers, 1873. Ansonia—Spring & Wilcox, 1848. New Haven—Patrick Dowling, 1870; Frances Donnelly, 1871; C. W. Blakeslee, 1863. Branford—C. D. Allen, 1879. Leetes Island—John Beattie, 1870. Stony Creek—John Robbins, 1878. Haddam—Isaac Arnold, 1800. Middletown—Burr & Whitmore, 1830. Lynn—C. J. McCurdy and E. E. Salisbury, 1876; Luce & Haskins, 1875. Waterford—J. B. Palmer & Co., 1835. Niantic—Warren Gates' Sons, 1832. Groton—Groton Granite Company, 1857; Chas. F. Stoll, 1869; Merritt, Gray & Co., 1840. Mason's Island—F. K. Ballow, 1879.

The following tables were compiled from the United States Census reports.

**1840—Amount of Granite, Marble and Other Stone Produced.**

|                     | Value     | Hands employed | Capital invested |
|---------------------|-----------|----------------|------------------|
| Maine .....         | \$107,506 | 305            | \$160,360        |
| New Hampshire ..... | 16,038    | 43             | 5,714            |
| Massachusetts ..... | 790,855   | 970            | 608,130          |
| Rhode Island .....  | 17,800    | 29             | 7,500            |
| Vermont .....       | 33,855    | 104            | 18,270           |
| Connecticut .....   | 312,469   | 692            | 332,275          |

**Value of Granite and Marble Manufactured.**

|                     |          |     |
|---------------------|----------|-----|
| Maine .....         | \$98,720 | 280 |
| New Hampshire ..... | 21,918   | 55  |
| Massachusetts ..... | 217,180  | 274 |
| Rhode Island .....  | 36,202   | 43  |
| Vermont .....       | 62,515   | 116 |
| Connecticut .....   | 50,880   | 55  |

**1860—Amount of Granite, Marble and Other Stone Worked.**

|                       | Firms | Capital invested | Cost of raw material | Hands employed | Annual cost of labor | Annual value of product |
|-----------------------|-------|------------------|----------------------|----------------|----------------------|-------------------------|
| Maine .....           | 29    | \$59,475         | \$49,597             | 120            | \$45,394             | \$184,238               |
| Massachusetts .....   | 25    | 282,875          | 153,653              | 660            | 290,656              | 522,097                 |
| New Hampshire .....   | 29    | 39,425           | 37,432               | 126            | 56,400               | 150,091                 |
| Rhode Island .....    | 19    | 104,800          | 52,107               | 146            | 56,280               | 123,200                 |
| Vermont (slate) ..... | 14    | 152,400          | 31,650               | 287            | 91,844               | 207,150                 |
| Connecticut .....     | ...   | .....            | .....                | ...            | .....                | .....                   |

**Total Amount Quarried.**

|                     |     |           |          |     |           |           |
|---------------------|-----|-----------|----------|-----|-----------|-----------|
| Maine .....         | 27  | \$312,325 | \$94,054 | 377 | \$137,224 | \$295,280 |
| Massachusetts ..... | 19  | 80,450    | 10,810   | 178 | 66,816    | 167,180   |
| New Hampshire ..... | 4   | 7,200     | 1,825    | 38  | 15,312    | 23,540    |
| Rhode Island .....  | 2   | 1,300     | 550      | 11  | 3,720     | 6,800     |
| Vermont .....       | ... | .....     | .....    | ... | .....     | .....     |
| Connecticut .....   | ... | .....     | .....    | ... | .....     | .....     |

## 1870—Total Amount of Granite, Marble and Other Stone Worked.

|                     |    |           |           |       |           |           |
|---------------------|----|-----------|-----------|-------|-----------|-----------|
| Maine .....         | 58 | \$149,541 | \$222,014 | 580   | \$305,250 | \$777,615 |
| Massachusetts ..... | 49 | 993,500   | 879,838   | 1,365 | 820,111   | 2,178,450 |
| New Hampshire ..... | 18 | 361,875   | 81,739    | 131   | 67,218    | 208,125   |
| Rhode Island .....  | 19 | 169,150   | 328,741   | 584   | .....     | 676,549   |
| Vermont .....       | 29 | 113,800   | 414,481   | 650   | 322,205   | 960,984   |
| Connecticut .....   | 24 | 169,910   | 108,010   | 234   | 141,701   | 322,844   |

## 1890.

|                     |     |           |           |       |           |           |
|---------------------|-----|-----------|-----------|-------|-----------|-----------|
| Maine .....         | 23  | \$758,040 | \$75,656  | 913   | \$696,717 | \$927,951 |
| Massachusetts ..... | 122 | 1,808,464 | 954,926   | 2,217 | 1,453,042 | 3,008,871 |
| New Hampshire ..... | 16  | 49,190    | 77,043    | 125   | 63,682    | 170,906   |
| Rhode Island .....  | 20  | 121,142   | 56,537    | 200   | 137,837   | 228,650   |
| Vermont .....       | 46  | 993,236   | 1,797,780 | 1,437 | 767,495   | 1,656,637 |
| Connecticut .....   | 18  | 140,085   | 76,887    | 151   | 108,333   | 217,971   |

## 1910.

|                     |    |             |           |       |             |             |
|---------------------|----|-------------|-----------|-------|-------------|-------------|
| Maine .....         | 42 | \$2,897,215 | \$325,626 | 2,423 | \$1,452,669 | \$2,382,186 |
| Massachusetts ..... | 93 | 6,749,507   | 110,596   | 3,603 | 2,356,534   | 5,032,781   |
| New Hampshire ..... | 23 | 671,164     | 171,778   | 712   | 409,357     | 798,599     |
| Rhode Island .....  | 7  | 349,080     | 180,321   | 401   | 275,768     | 567,176     |
| Vermont .....       | 50 | 12,279,424  | 877,028   | 4,893 | 2,271,500   | 4,965,067   |
| Connecticut .....   | 29 | 1,178,723   | 229,584   | 844   | 512,592     | 1,023,968   |

## 1870—Total Value of Tombstones and Monuments.

|                     |    |           |           |     |           |           |
|---------------------|----|-----------|-----------|-----|-----------|-----------|
| Massachusetts ..... | 61 | \$412,340 | \$419,147 | 499 | \$249,733 | \$879,969 |
| Vermont .....       | 38 | 76,750    | 59,585    | 141 | 48,095    | 173,864   |
| Connecticut .....   | 37 | 240,900   | 242,857   | 306 | 187,438   | 322,844   |

## 1880.

|                     |     |           |           |       |          |           |
|---------------------|-----|-----------|-----------|-------|----------|-----------|
| Maine .....         | 67  | \$137,600 | \$71,902  | 260   | \$90,230 | \$245,750 |
| Massachusetts ..... | 199 | 1,273,489 | 1,061,482 | 2,029 | 835,244  | 2,594,182 |
| New Hampshire ..... | 55  | 153,331   | 91,119    | 351   | 157,887  | 374,608   |
| Rhode Island .....  | 3   | 4,400     | 3,300     | 5     | 3,868    | 9,400     |
| Vermont .....       | 69  | 904,575   | 535,837   | 1,032 | 394,400  | 1,303,790 |
| Connecticut .....   | 63  | 522,850   | 139,203   | 322   | 164,432  | 419,948   |

## 1890.

|                     |     |           |          |       |           |           |
|---------------------|-----|-----------|----------|-------|-----------|-----------|
| Maine .....         | 66  | \$263,632 | \$71,297 | 318   | \$188,879 | \$141,404 |
| Massachusetts ..... | 191 | 1,420,433 | 600,000  | 2,025 | 1,405,184 | 2,609,176 |
| New Hampshire ..... | 34  | 176,750   | 71,658   | 205   | 126,038   | 235,353   |
| Rhode Island .....  | 20  | 72,497    | 47,728   | 94    | 71,327    | 143,940   |
| Vermont .....       | 96  | 650,513   | 343,680  | 1,205 | 793,927   | 1,492,384 |
| Connecticut .....   | 52  | 405,580   | 184,988  | 325   | 227,437   | 531,990   |

## 1910.

|                     |     |           |           |       |           |           |
|---------------------|-----|-----------|-----------|-------|-----------|-----------|
| Maine .....         | 19  | \$110,805 | \$50,197  | 109   | \$60,862  | \$172,623 |
| Massachusetts ..... | 135 | 1,468,584 | 661,576   | 1,717 | 1,071,478 | 2,651,289 |
| New Hampshire ..... | 32  | 297,988   | 108,806   | 336   | 201,084   | 406,405   |
| Rhode Island .....  | 16  | 329,126   | 97,409    | 357   | 244,191   | 67,453    |
| Vermont .....       | 179 | 2,187,911 | 1,133,257 | 3,204 | 2,183,425 | 4,615,379 |
| Connecticut .....   | 40  | 314,857   | 172,551   | 207   | 142,323   | 472,884   |

The first statistical work on Vermont granite by the United States Geological Survey was done in connection with the Tenth Census and gave the output of granite for the year ending May 31, 1880. There were 12 quarries reporting for that year, and the total output was 187,140 cubic feet, valued at \$59,675. The next figures available for Vermont granite were for 1886, when the output, chiefly monumental stone from the Barre quarries, was reported as 240,000 cubic feet valued at \$180,000. The year 1887 represented a gain of 25 per cent. over the output for 1886, and was 300,000 cubic feet, valued at \$225,000. The Eleventh Census

gave the output of granite for the census year as valued at \$581,870 and the Twelfth Census gave an output for the year 1902, the product of 68 quarries, valued at \$1,570,423, an increase of 169.9 per cent. in thirteen years, or of 2,531.6 per cent. for the twenty-three years, represented by different census figures. From the time of the Eleventh Census, the statistics of Vermont granite production have been regularly collected, the entire output increasing steadily, although not regularly, as the years were more or less differently affected by labor troubles, chiefly in the building trades. The stone of the State was at first chiefly used for monumental work, but recently a large quantity has been used in building, a small quantity made into paving blocks, and equally small quantities were sold as crushed stone for road making, ballast, curbing, etc.

The following table shows the value of the granite produced in Vermont, as compiled by the United States Geological Survey from 1880 to 1907:

| Year | Rough    |                 | Dressed  |                 | Paving              |          | Other purposes* | Total value |
|------|----------|-----------------|----------|-----------------|---------------------|----------|-----------------|-------------|
|      | Building | Monu-<br>mental | Building | Monu-<br>mental | Number<br>of blocks | Value    |                 |             |
| 1880 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | \$59,675    |
| 1886 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 180,000     |
| 1887 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 225,000     |
| 1888 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 278,000     |
| 1889 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 581,870     |
| 1890 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 610,963     |
| 1891 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 700,000     |
| 1892 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 675,000     |
| 1893 | .....    | .....           | .....    | .....           | .....               | .....    | .....           | 778,456     |
| 1894 | .....    | .....           | 8861,245 | .....           | .....               | \$32,711 | .....           | 893,956     |
| 1895 | .....    | .....           | 977,016  | .....           | .....               | 30,702   | .....           | 1,007,718   |
| 1896 | .....    | .....           | 864,526  | .....           | .....               | 30,990   | .....           | 896,516     |
| 1897 | .....    | 430,121         | .....    | 283,167         | \$341,034           | .....    | 16,770          | \$3,208     |
| 1898 | .....    | 631,634         | .....    | 113,922         | 416,878             | .....    | 4,446           | 17,338      |
| 1899 | .....    | 563,475         | .....    | 125,776         | 509,358             | .....    | 3,500           | 10,859      |
| 1900 | .....    | 526,370         | .....    | 49,763          | 527,053             | .....    | 225             | 10,377      |
| 1901 | .....    | 208,826         | .....    | 534,755         | 16,343              | 354,563  | .....           | 16,304      |
| 1902 | .....    | 28,845          | .....    | 756,007         | 280,567             | 453,187  | .....           | 2,855       |
| 1903 | .....    | 103,353         | .....    | 828,508         | 346,293             | 481,346  | .....           | 28,839      |
| 1904 | .....    | 83,148          | .....    | 707,830         | 912,801             | 615,057  | 382,758         | 14,745      |
| 1905 | .....    | 188,391         | .....    | 778,681         | 1,093,688           | 471,093  | 413,898         | 16,628      |
| 1906 | .....    | 47,154          | .....    | 993,220         | 1,422,862           | 451,222  | 282,930         | 9,557       |
| 1907 | .....    | 29,764          | .....    | 1,122,063       | 1,009,353           | 516,859  | 171,000         | 5,330       |
|      |          |                 |          |                 |                     |          |                 | 11,520      |
|      |          |                 |          |                 |                     |          |                 | 2,693,886   |

\* Includes stone for roads, curbing, ballast, etc.

The figures as given in the table show the values obtained free on board by the quarrymen for the stone quarried by them, and do not represent the stone sold by manufacturers. When quarrymen dress their own stone, the value of the dressed stone is given as representing the value of the material to the quarrymen. For the years 1906 and 1907, it has been possible to tabulate the quantity

of stone sold for building and for monumental work. This is of interest as showing the proportion of stone sold for building and for monumental purposes, and also showing practically the number of cubic feet of granite sold in Vermont for these years, the quantity of stone for other purposes being almost negligible.

In 1907 the total value of the granite produced in the United States was \$18,057,386, which, compared with the total value of Vermont of \$2,693,889, shows that in this year Vermont produced 14.92 per cent. of the total value of granite sold in the United States. In 1907 Vermont ranked first in the value of output, followed by Massachusetts and Maine with productions valued at \$2,934,825 and \$2,162,277, respectively. In 1906 Vermont ranked second in the value of production, the value for this year of \$2,934,825 being exceeded by Massachusetts with an output valued at \$3,327,416 and followed by Maine with an output of \$2,560,021, the total output of granite for Vermont in 1906 being 15.81 per cent. of the total of the United States.

The total value of granite sold, rough and dressed, by the quarrymen for building stone in the United States in 1906 was \$8,430,022, of which Vermont's share was \$1,470,016, or 17.44 per cent. of the total. In 1907 the total for the United States was \$6,033,362, with Vermont representing \$1,039,117, or 17.20 per cent. of the total. The total value of granite, including rough and dressed stone as sold by the quarrymen in the United States for monumental work, was, in 1906, \$4,115,665, Vermont's production being valued at \$1,444,442, or 35.10 per cent. In 1907 this total was \$4,338,719, Vermont representing \$1,637,922, or 37.75 per cent. The value of the total granite output for Vermont decreased somewhat in 1907 as compared with 1906, or from \$2,934,825 in 1906 to \$2,693,889 in 1907, a decrease of \$240,936. The principal decrease was in the value of the building stone sold, which, including rough and dressed stone, was from a value of \$1,470,016 in 1906 to \$1,039,117 in 1907, a loss of \$430,899. The total monumental stone, however, increased from a value of \$1,444,442 in 1906 to \$1,637,922 in 1907, a gain of \$193,480. The loss in building stone production was due to financial depression affecting general building conditions, especially in large cities.

In 1906, of the 1,849,045 cubic feet of stone sold for building and monumental work, the quantity for building purposes alone was 506,801 cubic feet or 27.41 per cent. of the total, while 1,342,244 cubic feet or 72.59 per cent. of the total was for monumental stone. The value, however, reported for the building stone, rough and

dressed, was \$1,470,016 or 50.44 per cent. of the total, and for the monumental stone \$1,444,442 or 49.56 per cent. of the total, these percentages being nearly the same, while the quantity of monumental stone was over two and one-half times as much as the quantity sold for building work. This is accounted for from the fact that by far the greater part of the monumental stone was sold to the manufacturers to be dressed, while the producers of building stone dressed their own material. The average price per cubic foot of rough building stone in 1906 was 59 cents; dressed, \$3.33. The average price per cubic foot of rough monumental stone in 1906 was 82 cents; dressed, \$3.56.

In the same manner the total quantity of building and monumental stone for 1907 amounted to 1,689,826 cubic feet; 347,775 cubic feet, or 20.58 per cent. being building stone and 1,342,051 cubic feet, or 79.42 per cent. being monumental stone. The total value of building and monumental stone was \$2,677,039, and of this \$1,039,117, or 38.82 per cent., was the value for building stone, and \$1,637,922, or 61.18 per cent., the value of monumental stone. The average price per cubic foot of rough building stone in 1907 was 69 cents; dressed stone, \$3.31, and the average price per cubic foot of rough monumental stone was 93 cents; dressed stone, \$3.71.

The total quantity and value of building and monumental stone sold in 1907 decreased 159,219 cubic feet in quantity and \$237,419 in value as compared with 1906, or from 1,849,045 cubic feet, valued at \$2,914,458 in 1906 to 1,689,826 cubic feet, valued at \$2,677,039 in 1907. The decrease was in the quantity and value of building stone, which amounted to 506,801 cubic feet, valued at \$1,470,016 in 1906 and 347,775 cubic feet valued at \$1,039,117 in 1907, a decrease of 159,026 cubic feet in quantity and \$430,899 in value. This is accounted for by the general depression in the building trade, fewer contracts being given to or taken by the quarrymen on account of the financial depression. In 1906 the output of monumental stone was 1,342,244 cubic feet, valued at \$1,444,442, and in 1907 it was 1,342,051 cubic feet, valued at \$1,637,922, a decrease of 193 cubic feet in quantity and an increase in value of \$193,480.

The largest output is from Washington County. Windsor County has the next largest production, the output being from Bethel, Chester and Windsor. The Caledonia County output ranks next. The Windham County output comes from Dummerston. The other localities giving smaller outputs, representing not more than one firm, are in Williamstown, Orange County, and Derby, Orleans County.

## CHAPTER VIII.

MILFORD, CONCORD AND FITZWILLIAM THE CHIEF GRANITE  
CENTRES OF NEW HAMPSHIRE.—RAPID GROWTH OF THE  
MONUMENT BUSINESS.—SOME OF THE FIRMS  
ENGAGED IN THE WORK.

**M**ILFORD, N. H., is located in the southeastern part of the State on the Souhegan River. It is 51 miles from Boston and is served by three divisions of the Boston & Maine R. R., via Ayer Junction, Manchester and Nashua Junction. It is one of the oldest towns in the State, with a population of over 4,000, and surrounded by a farming community which attracts many summer visitors. An electric light plant generating 500 h. p. supplies power to the various industries.

Before the coming of the white man there were several fordways by which the Indian crossed the Souhegan, called by the natives Souheganck (or Crooked) River. After the building of Shepard's mills upon the falls in 1741, this ford was known as the Mill ford by way of distinction. At the date of the incorporation of the town of Milford, 1794, the settlement in the vicinity had been, since 1738, known as the Mill ford village.

From the settlement of the town it has been known that in its soil were located vast ledges or quarries of granite and stone has always been liberally used for underpinning, bridges and faced walls, but it was not until 1833 that the stone was shipped from the town. At that date a set of steps 16'x5'x7" was loaded and hauled by oxen a distance of fifteen miles. Captain Peter Burns opened the quarry on his farm, and he is known as the father of the industry. But it was not until the town became possessed of railroad facilities that granite became an article of commerce to any considerable extent.

It is difficult to decide the exact date when the first quarrying operations were begun, but about a century ago a quarry was opened in the southwestern portion of the town on Burns Hill. It is a rugged rise of land and forms a part of a chain of hills that reaches back in a southerly direction. Captain Peter Burns was

succeeded by his sons, John M. and Luther M. Burns. Moses Howe took stone out of the King quarry seventy years ago. After him came Reed Dalton, and Thomas King, for whom the quarry was named, followed. F. J. Fuller from Quincy, Mass., took granite from the spot sometime after Mr. King abandoned the enterprise. The property is now owned by Charles Tonella. Other operatives have been Mr. O'Neil of Boston, Dustin Willaby, J. H. Miller and his son-in-law, Mr. Luce, from Quincy. Mr. Penniman, Jonathan Town, Charles W. Stevens, The Stevens Granite Company, The Ponemah Granite Company, Pond & Lovejoy, Milford Gregg, George Faulkner, H. W. & J. L. Hayden, King & Robertson, Yule & Ingraham, Comi Bros. and Souhegan Grantie Company.

The opening of the Wilton Railroad in 1851 made it possible to ship stone to out-of-town customers at a profit, and from that date the quarrying of stone has been one of the leading industries of the town. The side tracks upon the Wilton Railroad, and more recently, the tracks of the Fitchburg Railroad, have brought all the quarries upon the south side of the river into close connection with the markets of the country.

While the quarries producing building stone have been in process of development the demand for granite for monumental purposes has rapidly increased, and on the hills on the southeasterly portion of the town are found quarries of the finest grade of monumental stone. These quarries were opened in 1868, and the stone brought to the attention of the trade, with whom it immediately found favor. The quarries lie within a radius of four miles of Milford village, and between southwest, south and southeast directions from it; a few lie northwest of it. The granites are quartz monzonites of light, medium and dark gray shade, in places of a slight bluish, pinkish, or buff tinge, and always spangled with black mica. Their texture is even grained and very fine to fine, with feldspars and mica in the very fine. The monumental granites take a high polish, to which the fineness of the mica contributes. The hammered face of these quartz monzonites offers quite a contrast to the polished face, owing to their large percentage of soda-lime feldspar. The chief characteristics of these finer granites are the uniformity and delicacy of their shade or tint and the adaptability of the stone for fine carving. The crushing test of the blue stone is 24,950 pounds to the cubic inch.

The majority of the cutting plants are located on the Keene Branch of the Southern Division of the B. & M. R. R.; two plants

are situated on the Fitchburg Division; all the plants have their individual sidings and good loading facilities.

Paving stones and curb stones are cut and have been shipped in large quantities. The amount of granite quarried in 1890 was 20,000 tons.

CHARLES TONELLA, proprietor of the firm of Tonella & Sons, Milford, N. H., was born August 21, 1875, in the town of Angera, Italy. He served an apprenticeship of nearly four years in Italy, when he came to this country and went to East Concord, N. H., a few months later he went to Barre. About one year afterwards he was employed by the New England Granite Co. at Concord, N. H., where he remained one year, then moving to Milford, N. H., and worked several months for the New Westerly Granite Co., and later he returned to Concord, N. H., and entered the employ of the Railway Granite Co. He worked a few months at Mount Desert, Me., when he returned to Milford, N. H., with the Milford Granite Co., and in the year 1900, he and his father, Joseph Tonella, and his brother, Julian M., formed a partnership under the firm name of Tonella & Sons. The brother was born September 29, 1873, and died July 3, 1909. In 1910, Charles bought out the father's interest, also the King & Field's quarry, and in the spring of 1912 he bought out the brother's interest.

The cutting shed is well equipped with modern machinery, and gives employment to 24 hands, they doing all kinds of building—vaults, tombs, monuments and cemetery work, and at the quarries are producing monumental granite, edgestones, paving blocks, bridge work and crushed stone. In 1901 they bought the "Haines" orchard, where they first discovered the granite, and in 1902 they bought the "Echo Grove" farm, situated on the Brookline road, which is now the Queen quarry. This is a sheet quarry, being light pink and dark blue gray. In 1910 he bought the King-Fields quarry, the oldest monumental granite quarry in Milford, N. H. This is also a sheet quarry, the stone being dark pink and dark blue, of fine texture. In 1906, another, the Bald Hill quarry, located about three miles from the town on the Brookline road, was purchased. More than 100 men are employed in these quarries.

CONTI BROTHERS, Milford, N. H., was established in 1904 by John P. and Antony P. Conti, and in 1905 they built their present plant, the shed being 100x30 feet in dimensions, in which they em-

ploy 12 men, and use a 20 horse-power electric motor to drive an air compressor of 135 feet per minute and other machinery. They manufacture monuments and statuary, which are sent all over the country. Among the more noteworthy memorials cut by them may be mentioned the Scolle monument at Huntsville, Ala., and the Adlers memorial of New York; both statues on the latter are six feet in height. The brothers are natives of Brenno Usena, Province of Como, Italy, Antonio being born July 7, 1874, and his brother November 3, 1864. They learned their trade in Italy, and John went to Westerly, R. I., in 1886, and worked for Mr. Batterson several years, when he went to Concord, N. H., working there five years; then to Milford and founded the Milford Granite Co., where he was located until 1901, then becoming associated with his brother. Antony went to Concord, N. H., in 1891, and was employed by the Granite Railway Co. until 1897, when he moved to Milford, and in 1904 joined his brother in business.

THE NEW WESTERLY GRANITE COMPANY, Milford, N. H., was established September 13, 1895, by John Romani, John Bianchi and three others, in a very small way, and by honest and skillful work have grown in volume of business until they are one of the largest manufacturers in Milford, their circular plant having 14 doors, and they employ 75 men. They also own ten acres of fine quarry property, formerly known as the Smith Quarry Company, and which has been in operation for 30 years. The stone is blue in color, and is in excellent demand by manufacturers all over the country.

Mr. Romani is a native of Saltrio, Como, Italy, where he was born September 29, 1864. After a seven-year apprenticeship he worked two years as a journeyman in France, then joined the Italian army, in which he served three years. He went to Quincy in 1891, and was employed about five years with Patrick Fitzgerald, when he moved to Milford and joined Mr. Bianchi in business.

Mr. Bianchi was born in Besuschio, Como, Italy, October 15, 1861. After learning his trade he worked in France, Germany and Russia until 1885, when he went to Hallowell, Me., then to Quincy, Mass., where he was employed until 1895, when he moved to Milford and engaged in business.

John F. Pirovano was born at Lausanne, Switzerland, May 10, 1877, and in 1888 went to Quincy, where he graduated from the Quincy High School. He went to Milford in 1902, and was em-

ployed as manager by the New Westerly Granite Company. They always hold open house, and it is seldom that a visiting dealer goes away without buying.

JOHN BURNETT, of Burnett Bros., Milford, N. H., is a native of Bamffashire, Scotland, where he was born January 10, 1852. He served an apprenticeship of four years with McDonald, Field & Co. at Aberdeen, and in 1872 came to this country and worked several years as journeyman in Maine, New York, the West and Quincy, Mass. He then was employed ten years by Henry Murray of Boston, and fifteen years ago went to Milford and became associated in business with his brother Henry. He was president of the Milford Granite Manufacturers' Association from its organization until 1911, and in 1912 was elected selectman of the town of Milford. He is a member of Benevolent Lodge and Royal Arch Chapter, F. and A. M., also Clan McIntosh of Cambridge.

Henry Burnett was born in Aberdeen, Scotland, March 8, 1870, and learned his trade with the Smith Granite Company, Quincy, Mass., after which he worked in various sheds until he joined his brother in their present business. He is a member of Clan McGregor of Quincy.

They employ about 15 hands and have a well-appointed plant, the motive power being a 20 horse-power gasolene engine. They do a fine class of work, which goes to all parts of the country. The beautiful cross illustrated in this volume is a sample of their work.

THE FIRM OF P. C. FELLI & Co., Milford, N. H., was established in 1898 by P. Felli and John Fontana, and in 1905 A. J. Rossi was admitted to the firm. Mr. Felli retired in 1908, so that although the firm name remains the same the business is owned by Messrs. Rossi and Fontana. Mr. Fontana was born in Brenno Usena, Como, Italy, August 28, 1865, where he learned his trade. He served three years in the Italian infantry, and in 1887 went to Quincy, Mass., where he worked until 1898, when he moved to Milford to enter into partnership with the New Westerly Granite Company, and was with them three years, then becoming a partner of Mr. Felli. He is a member of Mutno Soccorso of Quincy.

Mr. Rossi was born in Besuschio, Como, Lombardy, October 22, 1882, and four years later went to Quincy with his parents, his father, John Rossi, being a stonecutter. In 1896 they moved to

Milford, where A. J. was graduated from the High School, after which he worked for the New Westerly Granite Company about one year, then for P. C. Felli & Co., he being admitted to the firm in 1905. Their plant is 125x75 feet in dimension, and they employ 12 men, making a specialty of carved work in all its branches. The McCoy monument at Toledo, O., is a splendid sample of their craft.

THE FIRM OF T. P. GARRITY & Co., Milford, N. H., is composed of T. P. Garrity and P. J. Soraghan, and they have the largest stone polishing establishment in that section. Mr. Soraghan is a native of County Cavan, Ireland, where he was born July 28, 1876, and in 1881 came to this country and located in Boston, where he worked at the brass moulding trade. He then went to Milford, N. H., and was employed by Henry Heyden, the first firm to do stone polishing in that town. In 1903 the present firm succeeded to the business and built the up-to-date plant they now occupy. It is equipped with two large wheels driven by a 25 horse-power electric motor, and they give employment to seven men. He is a member of Foresters of America and A. O. H.

FRANK E. MACCHI & Co., Milford, N. H. is a native of Indurio, Ohona, Italy, where he was born April 6, 1872, where he learned all branches of stonemasonry. He came to this country in 1899, and located in Milford in the employ of the Milford Granite Company. Three years later he went in business for himself, and in 1909 bought his present plant. He does all kinds of monumental work, a specialty being made of carving, which is sent all over the country, a sample of which is printed on another page.\*

F. NICOLA BERGAMI COMPANY, Milford, N. H., is a native of Venice, Italy, where he was born September 3, 1863, and in 1892 went to Barre, where he was employed four years. He then started in business for himself and remained there until 1899, when he moved to Milford, where he carried on business a few months, after which he was employed by the New Westerly Granite Co. eight years. He again engaged in business, and in 1909 bought his present plant, formerly occupied by the Union Granite Co. He manufactures all kinds of monumental work, which is sent to all parts of the country, his plant being equipped with polishing wheel and other machinery which are driven by a 12 horse-power electric motor.

**CONCORD.**

CONCORD, the capital of the State of New Hampshire, is situated on both sides of the Merrimack River, 75 miles from Boston, 270 miles from New York City, and has a population of about 20,000 inhabitants. The hill from which most of the granite is quarried is known as "Rattlesnake Hill," and is located about one mile from the State House. The hill is about three miles in length, and runs from north to south, the highest point being about 580 feet above high-water mark of the Merrimack River. Granite has been quarried from this hill since the earliest days of the settlement of the town. The stone for the New Hampshire old State Prison was quarried here in 1812, and for the New Hampshire State House in 1816-1819. The granite used in both these buildings was taken from boulders found on the surface, yet the State House is admirably preserved, with not the least sign of weathering or decomposition.

From Rattlesnake hill has been quarried some very fine granite, and has made but little impression on it, as the quantity is inexhaustible, while the quality is such that it can be used for all purposes for which granite is needed. An artesian well bored in the city through the solid granite, about 2,000 feet deep, did not show signs of reaching any other strata beneath the granite.

Luther Robin, who went to Concord from Amherst, N. H., was one of the most extensive quarry owners on the hill. About 1840 he bought a large farm from Mrs. Kimball, his mother-in-law, and opened a ledge quarry on what was known as the pasture in what is now the prison garden. On Pulpit ledge, on the hill, stone was taken for the United States Bank, this being the first granite to be shipped outside of the city. The work was cut by Mr. Sargent, whose shed was on Main street, near Fisk street. Robie & Robinson had a quarry on what was called the Poor House ledge, now owned by the New England Granite Company. William Clark and Charles Nutting took stone from this ledge. After Mr. Clark left the firm, Mr. Nutting carried on the business alone until his brother Charles was admitted a partner. Some time later Charles Nutting lost an eye, and was otherwise injured, by an explosion at the quarry. John Giles succeeded to the business, and he was followed by Sargent & Sullivan, Mr. Sargent having at one time cut stone for Mr. Robie. Samuel Alexander had a quarry at one end of the hill in the early fifties.

Concord granite is a muscovite-biotite granite, the essential constituents of which are quartz, orthoclose, muscovite and biotite; small crystals of apatite are nearly always present with more or less plagioclose. Government experts have endorsed it as a good and free stone to work, and it takes a high polish. In the tests made of the various granites by Prof. H. A. Cutting, the specific in gravity of Concord granite was 2,639; weight per cubic foot, 164.7; ratio of absorption, 1.778. In fire tests at 600 degrees Fahrenheit, it was uninjured; at 800 degrees it was slightly injured; at 900 degrees it cracked; at 1,000 it crumbled. For commercial purposes, Concord granite is divided into four grades: First—The best for sculpture, monumental and cemetery purposes. Second—The next best for general building work. Third—For underpinning, coping for walls, steps, and hitching posts. Fourth—For foundation stones, piers, abutments, and other purposes in which uniformity of color is not required.

Among the notable buildings and monuments cut in Concord may be mentioned the Congressional Library, Washington; Standard Oil Company's Building, New York, by the New England Granite Company; City Hall, Boston; New England Mutual Life Insurance Building, Boston, and the New Hampshire State Library, Concord, by the Granite Railway Company; Soldiers' and Sailors' Memorial Arch, Concord, by Ola Anderson; Christian Science Church, Concord; Carpenter Tomb, Manchester, N. H., by Thomas Fox. Ether Monument, Boston, Mass., Ayer Monument, Lowell, Mass., and the Hannah Dustin Monument, Penacook, N. H., were made by manufacturers in that city.

The Granite Manufacturers' Association of Concord was organized in 1892 with William Foley as president, and Orin F. Swain, secretary. Mr. Henneberry succeeded Mr. Swain and held the office twelve years, when he resigned in favor of F. R. Clark, the present secretary. The original members were as follows: New England Granite Works, Granite Railway Company, M. G. Gannon, J. R. Hosking & Co., M. J. McGuire, Wm. Foley & Sons, A. D. Harrison, A. G. McAlpine & Co., W. H. Laws, J. Trenoweth, Clancy & Co., La Blanc & Daily, M. Casey, Oliver Racine, B. O'Connor & Co., D. Weathers, Concord Granite Company, Ola Anderson, Thos. Nawn, Dimond & Fox, LaBelle & Co., J. A. Fraser, Thos. Fox, John Swenson, J. H. Flood, W. S. Lougee, L. O. Peabody, F. R. Clark, Gay Bros., Crowley & Quinn, B. T. Putney and Thos. Harrison.

JOHN HENNEBERRY AND PETER HALLIGAN established their business in Concord, N. H., under the firm name of Henneberry & Halligan, in 1896, although in 1892 Mr. Henneberry and his brother Michael had formed a partnership under the firm name of Henneberry Bros., which continued until the death of the latter in 1896, when it took its present name. Their plant is fully equipped with modern machinery, including two 12 ton derricks driven by a 30 horse power electric motor. Fifteen men are employed, and they do all kinds of fine monumental work. A fair example of the character being the monument at Hiawatha, Kansas, recently erected.

Mr. Henneberry is a native of County Cork, Ireland, where he was born September 8, 1856. He came to this country in 1873, and located in Manchester, N. H., serving his apprenticeship in that city and remaining there except for a short interval until 1876, when he worked for the Gilman & Cheney firm in Charlestown, Mass. He then moved to Concord, where he worked at his trade until 1892, when he and his brother engaged in business.

Mr. Halligan was born in Co. Mayo, Ireland, in 1860. He came to this country in 1878. He worked in the quarries in St. Louis, Mo., and had charge of the derrick work in the famous McDonald quarries in that city for several years. He came to Concord, N. H., in 1888, and served his apprenticeship with Geo. W. Waters and worked at the trade since. He became a member of the firm of Henneberry Bros. & Co. in 1892, and on the death of Michael took a half interest in the present firm. He is a man of marked ability in the handling of the work in the yard and has full charge of that department.

PERRY BROS., successors to W. H. Perry & Co., Concord, N. H., was established in 1881 by W. H. Perry, a native of Cornwall, England, where he was born in 1849. He died September 22, 1910, and his sons, Lawrence B. and Harry J., succeeded to the business and changed the firm name to Perry Bros. Lawrence and Harry are natives of Concord, N. H., the former being born March 8, 1887, and the latter October 22, 1885. They learned the business from their father, for whom they worked several years. Harry looks after the manufacturing end, while Lawrence does the drafting and office work. They do all kinds of monumental and mausoleum work, a specimen of which is shown on another page. They also quarry their own stock, which is known to the trade as New Barre.

BOTH **ALFRED LARSON AND RICHARD CARLSON**, of the firm of **Larson & Carlson**, Concord, N. H., are natives of Ryholm, Sweden, the former being born December 23, 1867, and the latter September 29, 1869. Mr. Larson went to Concord in 1887, and was employed by John Swenson until 1892, when he went to Manchester, N. H., with R. T. Stevens & Co., and worked about two years, after which he moved to Woodsville, N. H., and was foreman for the French Pond Granite Co. In 1895 he returned to Concord in the employ of Henneberry & Halligan, where he remained a few months, when he went to work for Thomas Fox. He left that firm and was foreman for Ola Anderson, after which he engaged in business under the firm name of A. Larson & Co., and in January, 1908, formed a partnership with Mr. Carlson. He is a member of White Mountain Lodge, I. O. O. F., and the Swedish Order of Vasa.

Mr. Carlson went to Concord in 1889, and worked for J. Swenson three years, after which he was employed by Henneberry & Halligan about five years, and with Thomas Fox eleven years, when he joined Mr. Larson. He is a member of H. O. F.

The firm built their present plant, where they do all kinds of monumental work, making a specialty of carving, a sample of which may be seen in the illustration on another page.

**THOMAS FOX**, Concord, N. H., is a native of Limerick, Ireland, where he was born July 8, 1865, and in 1887 came to the United States and worked for Frank Clark. A few months later he was employed by Blanchard & Co., and in 1889 bought the business of that firm. Later he bought Mr. Anderson's polishing plant, and in 1894 he acquired the quarry of Gay Bros.' consisting of 14 acres. His polishing, cutting and quarry plants are thoroughly up-to-date and he gives employment to a large force of skillful men.

Mr. Fox does all kinds of monumental, vault and building work, which is sent all over the country. Among the more notable of his productions may be mentioned the Christian Science Church, at Concord, N. H., the Shelden Library of St. Paul's School, Concord, N. H., and the Lamb Mausoleum at Clinton, Ohio.

**ALBERT G. McALPINE**, of the firm of A. G. McAlpine & Co., Concord, N. H., has been a granite manufacturer since 1876, when

he and Luther Blanchard formed a partnership as Blanchard & McAlpine and carried on business in West Concord. Two years later he bought his partner's interest, and continued alone until 1883, when he became associated with O. F. Swain under the firm name of A. G. McAlpine & Co. This was dissolved in 1897, Mr. McAlpine carrying on the business alone until 1911, when William N. Moody, his son-in-law, was admitted a partner. Mr. McAlpine was born in Hopkinton, N. H., January 18, 1849, and learned his trade with David Blanchard, of Concord, in 1868, with whom he worked one year, when he moved to Worcester, Mass., and was employed two years by Alfred Mann. He then returned to Concord and engaged in business. Their plant is well equipped with modern machinery and gives employment to eighteen men, and they manufacture all kinds of monumental pieces which are erected all over the country.

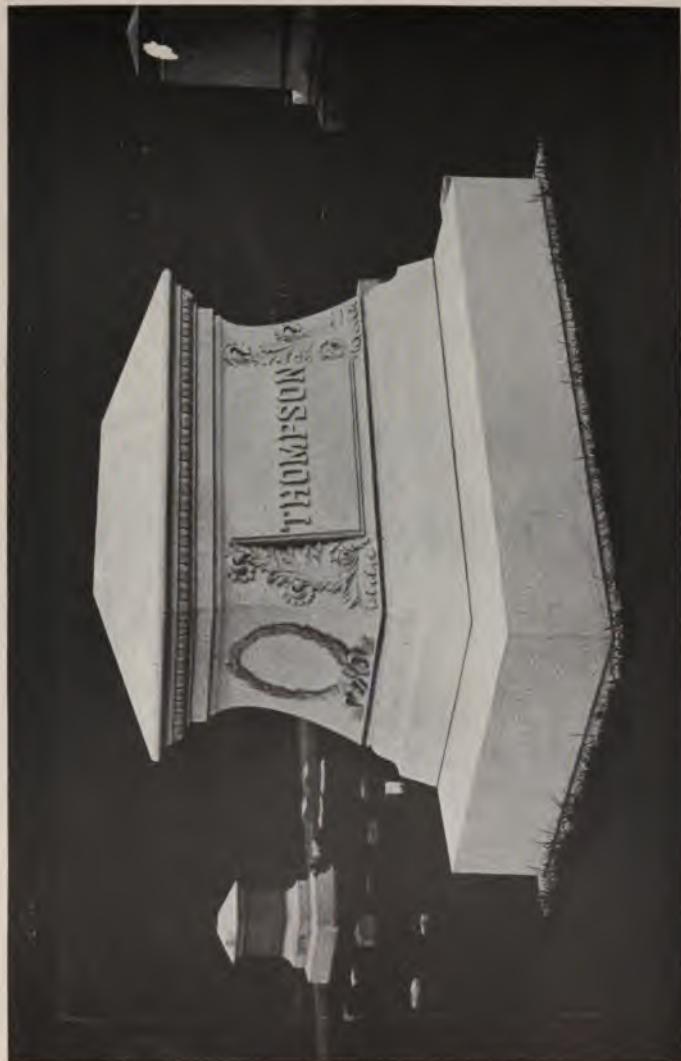
#### FITZWILLIAM DEPOT.

WILLIAM E. BLODGETT is a native of Fitzwilliam, N. H., where he was born March 27, 1855. After leaving school he learned stone cutting, serving an apprenticeship with his father, Ethen Blodgett, and was associated with him under the firm name of Ethen Blodgett & Co. for fifteen years. In 1892 they sold out to Darling Brothers and A. M. Evans, all of Worcester, and he was employed as superintendent of their plant. Two years later he bought out the business of S. B. Thompson of Fitzwilliam, and in 1896 his brother Thomas was admitted a member of the firm of W. E. Blodgett & Co., which continued until 1910, when he bought his brother's interest. In 1901 the present plant was built and equipped with modern machinery for doing all kinds of monumental work which goes to all parts of the United States. He now gives employment to a blacksmith and several cutters.

THE FIRM OF THOMPSON & MCKINLEY, Fitzwilliam Depot, N. H., is composed of Edgar M. Thompson and Robert McKinley. Mr. Thompson is a native of Troy, N. H., where he was born November 8, 1864, and after leaving school learned the chair making trade in the shop of Wilson & Co., of Fitzwilliam, at which he worked until 1892, when he learned granite cutting. In 1894 he engaged in business with H. B. Bailey under the firm name of the Fitzwilliam Granite Co., which firm dissolved 18 months later. In 1903 Mr. McKinley and Mr. Thompson established the present firm,



CUT BY HENNEBERRY & HALLIGAN, CONCORD, N. H.



CUT BY LARSON & CARLSON, CONCORD, N. H.



CUT BY PERRY BROTHERS, CONCORD, N. H.



(Copyrighted, Kimball & Co., Concord.)

CHRISTIAN SCIENCE CHURCH, CONCORD, N. H.  
*Stone Supplied by Thomas Fox, Concord, N. H.*

and besides the cutting plant they own a quarry that is producing a very fine granite for monumental and building purposes. Both plants are well equipped with modern machinery and they employ 17 men.

This firm does a large business in monumental and building work of all kinds, among their more notable products being the Howe Mausoleum at Cleveland, Ohio, and Chandler statue at Madrid, N. Y. Mr. Thompson is a member of Manadnock Lodge, F. & A. M.

FASOLI BROTHERS, Fitzwilliam Depot, N. H., have a well-earned reputation for high-grade carved and moulded work, of which they make a specialty. A sample of the work done by Antonio Fasoli in Italy is shown on another page. He was born in Petro, Italy, November 17, 1878, and after serving an apprenticeship of ten years in his native place, he went to Barre, and was employed by the Star Granite Co. five years. He then moved to Fitzwilliam and established himself in business. His plant is well equipped for doing monumental work of all kinds and he gives employment to six men.

EDWARD YON, proprietor of the firm of Edward Yon & Co., Fitzwilliam Depot, N. H., is a native of Biella, Piedicorollo, Italy, where he was born October 16, 1864, and came to the United States in 1880. He located in Providence, R. I., where he remained until 1888, at which time he moved to Fitzwilliam and worked as a journeyman five years, when he engaged in business for himself. His son, Philip, was born in Leominster, Mass., June 27, 1894, and after leaving school joined his father in business. They make a specialty of bases, but do all kinds of monumental work, a specimen of which is illustrated on another page.

## CHAPTER IX.

THE GRANITE QUARRIES OF MAINE.—PAVING CUTTERS AND  
THEIR WAGES.—CONNECTICUT GRANITE.—THE INDUSTRY  
IN RHODE ISLAND.

**I**N Maine, not only are the quarries of great extent and depth, and generally located on hills, but they are generally sufficiently bare of vegetation to conceal the outline. Many of these quarries are sheet quarries, and in every case where vertical joints are not present, breaking up the sheets to such an extent as to conceal their direction. The round form of the hill is plainly seen to be due to the gentle curves of the sheets.

At Sullivan the granite has a set of cleavages which causes it to break out in long rectangular prisms, a form peculiarly favorable for the quarryman's work. The rather reddish granites outcrop along the coast to the eastward. On the shores of Somes Sound, a deep inlet that penetrates the island of Mount Desert, there are quarries of a light red granite. Here, or elsewhere along the shore, the best quarries are found in the sides of the hills.

Excellent quarries exist at the head of Blue Hill bay. Deer Island and Vinal Haven Island have excellent quarries of the same stone. On the latter island the stone splits in very large blocks. On the west side of Penobscot bay there are exterior quarries in Thomaston and Saint George, near Richland. West of the Penobscot, the quarries are not limited to the coast line, but some are situated on the Kennebec. The granite character of the coast is continued to the New Hampshire line, and the numerous small and a few large quarries attest the general goodness of the stone. The quarries afford excellent conditions for working. The stone opens easily, having the peculiar inchoate joints that are such striking features in the syenite of New England. There are generally, at least, two of these rift lines. Then there is more or less complete division by what appears to be true beds, as well as joints, so that the division of the rock is as complete as could be desired. At the same time the lines of weakness in the rock are not so numerous as often to make the quarried masses too small for use, as is sometimes the case in other districts.

The Red Beach granite quarried near Red Beach, Jonesboro and Calais, is used principally for monuments, and to some extent for general building purposes. It compares in appearance very favorably with the Peterhead Scotch, and the Nova Scotia red granite. The granite workers here were largely Aberdeen Scotchmen, and their polishing machines were adapted from Scotch models. The trap dikes in Washington county furnish white and black granite, and are quarried chiefly for monumental purposes, and are shipped to all parts of the country. Six miles southeast from Madison Point, on Pleasant river, one of the principal quarries is located. This is a "black quarry," that is to say, the horizontal or concentric sheets of ordinary granite are few. Near West Sullivan, a light gray biotite granite, sometimes having a pinkish tint, is quarried for general building purposes, monuments, paving and curbing. It may be said that the beautiful cleavages of this stone are among the characteristics of the Sullivan granite, and are of great advantage in making paving blocks, as the blocks are shaped from the material with ease, a few slight blows often suffice to reduce the stone to a proper shape. A mile north of West Sullivan is located a typical sheet quarry, the sheets running from two to six feet in thickness, having a very smooth, almost plain, though gently curved surface, dipping slightly to the northwest. Nearly a mile to the north of Sullivan is a quarry producing excellent splitting stock, the sheets running from three to seven feet thick.

Near Franklin, a light gray, massive biotite granite, is quarried for curbing, paving and cemetery work. On Somes Sound a similar stone is quarried for general building purposes, bridge construction and paving. The position of the quarries on Mount Desert Island is peculiarly good for shipping, as they lie near the head of Somes Sound, along a narrow and very deep ford, running several miles inland from the Southwest Harbor, between the mountain. One of the quarries is situated on the side of the hill and at the water's edge. The large sheets of stone have a steep dip from the summit of the hill down to the water's edge. The rift is on the lift of the sheets, and the grain, as usual, is parallel to the great north and south points.

Two miles south of Somerville there is a granite quarry. Near East Bluehill a biotite granite is quarried for general building purposes and paving. It is a compact, good, safe, and free working stone, and takes a good polish. Specimens were tested which showed a crushing resistance of 108,000 pounds to a two-inch cube.

The stone lies in sheet, often irregular, from three to ten feet in thickness, and the jointing is sometimes irregular in many of the openings. Patches and occasional veins of white granite are present. Near Deer Island the granite is a good face working stone, and the sheets in one of the quarries reach a thickness of eighteen feet. They extend into the hill nearly horizontally and are intersected by occasional vertical joints. Another quarry in this vicinity lies in a steep hill, the slope running down to the water's edge. The principal quarry at Frankfort is situated on Mount Waldo, overlooking the Penobscot river, and at an elevation of some 320 feet above high tide. It is a situation allowing of easy disposition of waste; the stone lies in immense sheets dipping off from the mountain, and varying in thickness from one foot to twenty feet. This stone was in use in the construction of many of the eastern forts before the Civil War. But a year or so of the war demonstrated the comparative inferiority of stone for this purpose, and caused the building of stone forts on the Atlantic coast to be discontinued, and the business of several of the Maine quarries was for a time diminished. Near Prospect, massive biotite granite is quarried for street work, bases, heads, platforms and bridge construction.

In the report of the Commissioner of Industrial and Labor Statistics of Maine for 1889, the only report on the granite industry published by the State, we find many interesting facts.

In the State there are, in round numbers, 4,000 men employed in the granite industry, divided as follows: 1,400 granite cutters, 1,000 paving cutters and 1,600 attendant laborers, including tool sharpeners, quarrymen, teamsters, drag tenders, boxers (men who box the cut stone), draftsmen, foremen, engineers, laborers, superintendents, polishers, clerks, etc. Besides this number there are employed through this industry 500 more engaged in sailing vessels that are almost constantly employed in freighting the granite to the different centers of trade.

The wages paid to day-workers throughout the State are as follows:

|                           | Cents per hour |         | Cents |
|---------------------------|----------------|---------|-------|
| Granite cutters . . . . . | .25 to .30     | average | .27½  |
| Paving cutters . . . . .  | .25 to .30     | "       | .27½  |
| Tool sharpeners . . . . . | .22½ to .27½   | "       | .25   |
| Quarrymen . . . . .       | .15 to .17½    | "       | .16½  |
| Teamsters . . . . .       | .16 to .21½    | "       | .18   |
| Laborers . . . . .        | .12½ to .18    | "       | .15   |
| Polishers . . . . .       | .15 to .20     | "       | .17½  |

These figures, by themselves, might be misleading to those unacquainted with the granite business, for while they are correct they apply to but a small portion of those employed, probably not more than 12 per cent.; and those so employed are generally the best of the workmen. The average annual earnings of granite cutters working by the day, at an average of \$2.75 for 287 days, allowing 25 days for holidays and shortening of the days in winter, would be \$789.25.

The average annual earnings of granite cutters (piece workers) is \$600.00, an average for 287 full days of \$2.09 per day.

The average annual earnings of tool sharpeners, working by the day, at an average of \$2.50 for 287 full days, is \$717.50.

The average annual earnings of the quarrymen, at an average of \$1.65 per day, is \$396.00, an average for 287 days of \$1.38 per day, showing a loss to the quarrymen, in addition to shortening of days, of 47 days from bad weather.

The season for making paving profitably, does not exceed eight months, although the business is carried on at most of the places throughout the year. As most of the paving cutters work out of doors, considerable time is lost by bad weather. The average number of days worked for eight months is 180; for that time the average pay would be \$2.50 per day, or a total for 180 days of \$450.00. During the four winter months the average would be about \$30.00 per month, a total for the year of \$570.00, or an average for 287 days of \$1.99 per day. The price for paving working is from \$20.00 to \$30.00 per thousand, an average of about \$26.00 per thousand, \$20.00 being for stock on the dump, \$30.00 being for motion work. (The paving cutter quarrying his own stone.)

The whole number of quarries operated to any considerable extent in 1888 and 1889 was about 55, and the whole number of workmen employed about 4,000.

VINALHAVEN. BODWELL GRANITE COMPANY.—The extensive quarries at Vinalhaven have been largely worked for a number of years, large contracts being executed for all parts of the country, some of which are the State, War and Navy Building, Washington; Masonic Temple, Philadelphia; Post Office, Cincinnati, Ohio; Board of Trade, Chicago; Brooklyn Post Office, St. Louis and Brooklyn bridges. The General Wool monument, which weighed, when completed (foundation and all), some 650 tons, was taken from these quarries at Vinalhaven. The Bodwell Granite Company was incor-

porated in 1871, and since that time an extensive business has been carried on. Some years as many as 1,500 men have been employed. The granite produced at Vinalhaven is of many different kinds and colors, both fine and coarse grained, but the most notable and most extensively used is taken from what is known as the Sands and Harbor quarries. Large quantities of red granite taken from the company's quarries at Jonesboro is also used both here and at Spruce Head.

**BOOTH BROS. AND HURRICANE ISLAND GRANITE COMPANY**, located at Hurricane Island, Knox County.—These works were first opened in 1870 by General Davis Tillson, Garrett Coughlin, John Hogan and Patrick McNamara, General Tillson becoming shortly after the sole proprietor. Some very large contracts, notably the St. Louis Post Office, have been filled from the quarries at Hurricane, furnishing employment at times to hundreds of men. The stone is gray in color, coarse grained and an excellent stone for building purposes and paving. Large quantities have been shipped to the West and South for monumental purposes.

**SULLIVAN QUARRIES.**—The Granite quarries of Sullivan have been extensively operated for over fifty years and are the oldest in Hancock County, and among the oldest in the State. The principal branch of the business carried on at present is the paving, although large contracts of hammered stone have been filled in the past.

The quarries are situated on Mt. Washington Ridge, which lies along an arm of Frenchman's Bay, known as Taunton Bay. Leaving Sullivan, and walking a distance of about one and a half miles, we reach West Sullivan, where the granite business is principally carried on. The quarries lie along the ridge for a distance of five or six miles, and are worked by the following parties: Stimpson Quarry Company, Crabtree & Hovey, Joseph H. West, Alonzo Abbott, G. W. Pettengill & Son. These are the principal operators, while a few others have small crews of men, and quarry stone on sub-contracts from the large firms. Among these are Alexander Taylor, E. F. Chaplin, Wm. McKenzie and Hovey & Hooper.

The Sullivan Quarry Company, operated by J. H. Stimpson, the oldest of the Sullivan quarries. They have been in periodic operation for over fifty years, and in constant operation for the past fifteen years. General Sullivan of Revolutionary fame, from whom the town received its name, quarried stone, it is said, from these hills, to build a dam, the ruins of which can be

seen in a stream of Frenchman's Bay. In former years when large stone cutting operations were carried on, the cut stone was conveyed from the quarries by steam engine and cars, on tracks laid to the wharf; but this method proving unprofitable in paving operations, was discontinued some years ago. The distance from the quarry to the wharf is about one mile, and the stone is now conveyed by teams. The teamsters generally own their teams, and are hired to work by the piece, trucking the paving to the landings for a stated amount per thousand blocks; this same system being in operation at all the other quarries in town. This company have five main quarries in operation, and motions, as they are called, covering a territory of two hundred acres. These motions are opened by the paving cutters, they doing the quarrying and cutting out the blocks at so much per thousand blocks.

The quarries lay in sheets varying in thickness. The quality is medium fine grained and gray in color. All the quarries in the vicinity are of the same quality and lay in about the same form as the Stimpson quarries. Free and fine in the grain, this stone is considered excellent for paving work. In past years the main quarries of this company have been almost entirely worked for paving but later was used for curbing and other stone cutting work. A store is run in connection with these works, prices being generally as low as at other places in town. Most of the houses in which the workmen live are owned by the company, and are near the quarries. Many of them are of the shanty finish, but are clean and comfortable enough, except in severe weather. The amount charged for rents is from \$2.50 to \$4.00 per month. Many of the men build shanties and do their own cooking, preferring this in the summer time to boarding. Although the company has boarding houses, most of the men board in private families. These same conditions will apply to the other firms as they are about all worked on the same principle.

WEST SULLIVAN.—This quarry has been in operation about eighteen years, operated by the proprietors, Messrs. Crabtree and Havey.

Joseph H. West has been in business for some years. Besides his interest at West Sullivan, he has a large force engaged at Franklin, a town adjoining Sullivan.

G. W. Pettengill & Son are mostly engaged at cutting curbing. A few paving cutters are also employed working in motion at \$30.00

per thousand. A large number of quarrymen and laborers of West Sullivan and vicinity are natives of New Brunswick and Nova Scotia. They are employed in the woods during the winter and come here in the summer.

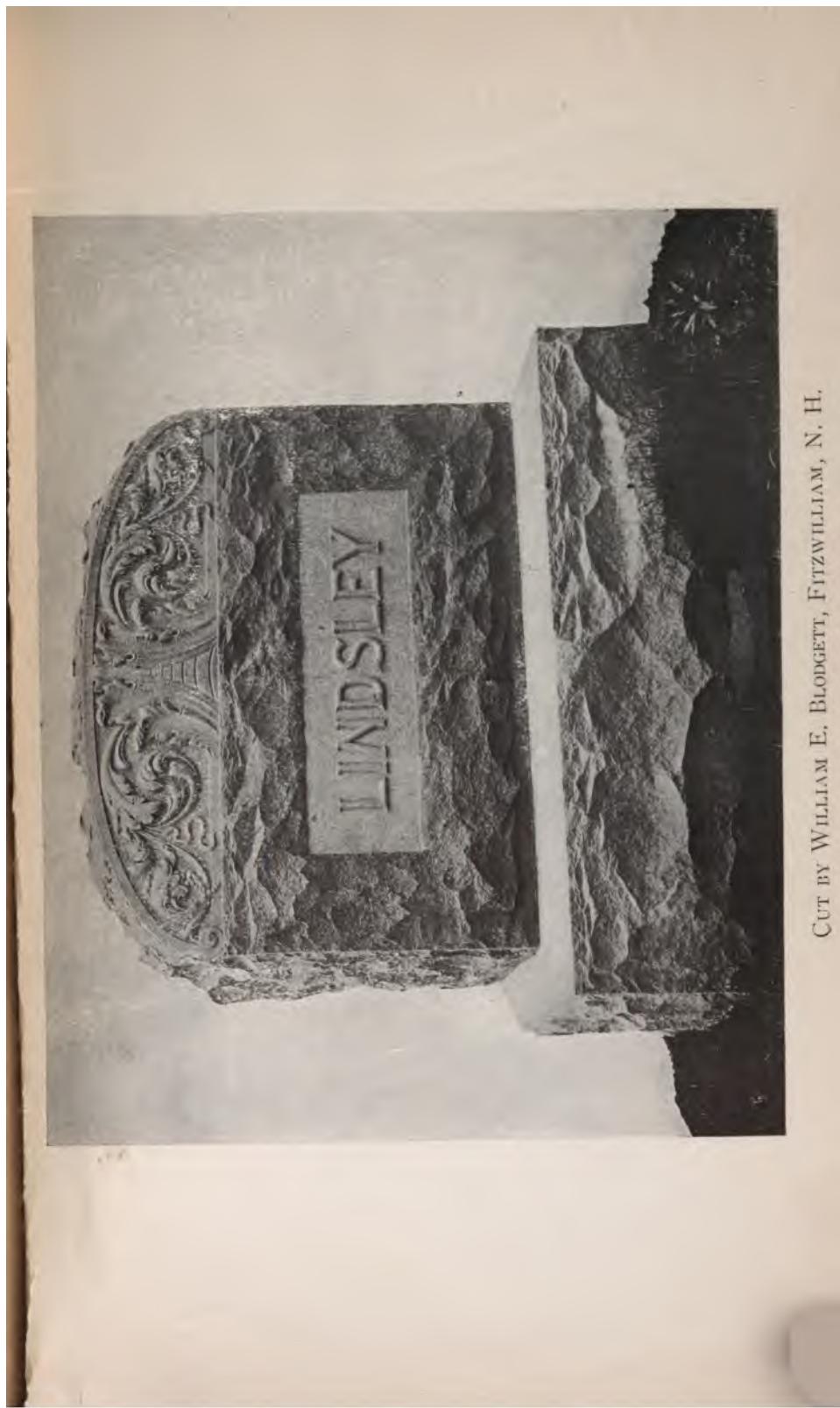
Most of the paving made here are made in motions, and the earnings of the workmen depend a great deal on the kind of a motion he has to work, the stone being good to work; if the man strikes a good motion he makes good pay, but there are more poor motions than good ones, and the men as a whole prefer to work stock on the dumps quarried for them, than to work in the motions, the work being lighter, and more money can be earned. A cutter can make, when his motion is good, and no clearing to be done, \$75.00 or \$80.00 per month, but at times he will not make more than half of it, so that his average is not so large as many would have it appear.

ROUND POND.—Round Pond in town of Bristol, Lincoln County. Quarries operated by Brown, McAllister & Co. of New York. The granite produced from this quarry is of a fine quality, very even in the grain, and taking a very high polish, showing splendid contrast with hammered work. The stone is used mostly for monumental and cemetery purposes, large quantities being shipped to the yards at New York.

SPRUCE HEAD, in town of Thomaston.—The quarries are operated by Bodwell Granite Company. It was first opened about 1836, very little being done until about 1860, the firm of Cobb, White & Case of Rockland having then commenced active operations continuing until consolidated with Bodwell Granite Company. The granite of this quarry is gray in color, differing somewhat in its make-up from other granite in vicinity, and although susceptible to a high polish is used almost exclusively for building purposes. Among the many contracts filled from Spruce Head quarries are the Court House and Post Office, Atlanta, Ga.; Albany Post Office, Philadelphia City Buildings; Gate House, New York City; polished columns for Auditorium, Chicago, etc., etc.

EAST BLUE HILL.—The quarries at this place are held by Christopher Binder & Sons, and have been in operation about four years. The contractors are M. A. McGown & Co. of Washington, D. C.

JONESBORO' BODWELL GRANITE COMPANY.—The Jonesboro' Granite Quarries are located in town of Jonesboro', Washington County, and are operated by the Bodwell Granite Company, Ephraim



CUT BY WILLIAM E. BLODGETT, FRIZWILLIAM, N. H.



DESIGNED AND SET AT FEWARA, ROVIGO, ITALY, BY ANTONIO  
FASOLI, FITZWILLIAM, N. H.

Whitney, Superintendent. The granite taken from this quarry is of a red color and very highly prized. It takes a nice polish and is used very much for trimmings, columns, etc. The granite is shipped to Vinalhaven and Spruce Head, where it is dressed and prepared for the market. The quarry is operated about nine months of the year. In winter most of the men go in the woods for the company, they having large lumbering interests there.

HALLOWELL CENTRAL GRANITE COMPANY, Archie & Augustine, proprietors.—This firm has been in operation about four years. The quarry and sheds are located near the quarries of the Hallowell works. The stone produced is without doubt as fine as there is in the State, and is used mostly for statuary and monumental work.

Mt. WALDO GRANITE COMPANY.—Mt. Waldo Granite Company, located at Frankfort on the Penobscot river, first opened in 1852, operated more or less since and quite extensively at times by Messrs. Pierce & Rowe. The quarries are located almost on the top of the mountain from which they receive their name. Two kinds of stone are found at these quarries, one being coarse grained, the other fine and of excellent quality. It hammers very light, works very easily and splits to almost any dimension.

To get the stone from the mountain side to the shipping point, a distance of about one-fourth of a mile, a track has been laid, running with an endless chain. The loaded car down takes an empty car back, and by this means a great amount of stone is handled during the day. At these quarries can also be seen a "blondin," such as is used at Long Cove, by which means large stones are taken through the air to a point where they can be handled with teams.

QUARRY OF BOOTH BROS. & HURRICANE GRANITE COMPANY is situated at what is called Pequod in the town of Vinalhaven. This is a branch of the large business carried on by this firm.

HALLOWELL GRANITE WORKS, located at Hallowell, operated by the Hallowell Granite Works Company.—This company, aside from their large building operations, are the largest producers of monumental, statuary and ornamental work in the State. In almost every city of the country can be seen the handiwork of the Hallowell mechanics. The State House at Albany, New York; the Equitable Building, New York; the Yorktown Monument, Plymouth, Mass.; Soldiers' Monument, Boston Common; Memorial Monuments for Maine troops at Gettysburg, etc. The quarries of this company are

two miles and a half from the city and are very extensive. Stone of almost any dimension can be quarried.

MAINE GRANITE AND IMPROVEMENT COMPANY, BELFAST. In operation about eight years. The granite used at these works is taken from the company's quarries at Somes Sound and Otter Creek, Mt. Desert, Dodlin Hill and Norridgewock, all of excellent quality, the Otter Creek stone being a dark red and susceptible of a high polish.

GRANITE WORKS AT LONG COVE.—Long Cove granite quarry, in town of St. George, operated by Booth Bros. and Hurricane Granite Company. This quarry is worked quite extensively both in paving making and stone cutting. Nearly 1,000,000 blocks were shipped from these works in 1888 and among the building contracts filled are Albany Court House and Post Office, Fall River Court House, etc. The stone is fine grain, looks nice hammered and takes well in the market.

FREEPORT GRANITE WORKS, E. B. Mallett, Jr., proprietor.—In operation about four years. Granite is gray in color, fine grained, and works nicely to an edge. Quantities of this stock are sent to the West, many preferring it for monumental and statuary work.

CROWN HILL.—The Crown Hill Granite Company, Vinalhaven, J. P. Armhurst, proprietor, has been in operation one year.

#### CONNECTICUT.

Bristol has an area of about fifteen square miles of granite. It is of varying texture and color but generally light gray and is used for building. Within the town of Avon and Canton is an area of granite that forms a flattened ridge between Farmington River and Roaring Brook, and also the prominent peak of Mt. Harr, north of Canton Station. At Collinsville this formation is particularly well exposed, and has received its name from that village; it is used for building. Large tracts of stone called Thomaston granite are found in Thomaston, Goshen, Weston, Westport, New Canaan and Waterbury. The Thomaston granite is very light in color, fine-grained and compact, and is a remarkably beautiful and excellent stone specially adapted to monumental work.

Millstone Point stone is dark gray, firm, homogeneous texture, showing strong contrast of color between polished and dressed surfaces. The granite from Leetes Island is reddish gray, rather coarse-

grained gneiss, a handsome building stone. Mystic Bridge produces a fine-grained, light and dark stone, homogeneous in texture, and handsome.

Stony Creek granite is pale red in color, of medium grain, and consists of flesh color old orthoclose, greenish white oligoclose, and glossy quartz, with specks of black hornblende and magnetic iron. It is a strong, compact and handsome stone, having an agreeable tint, taking a high polish and good for both construction and ornament. Another variety is a gray, fine-grained stone of good quality. Umpewang, Norwalk, has a fine-grained, pinkish gray granite, homogeneous and compact, a good building stone.

The Glastonbury Granite occupies an area extending from the north line of the State in Somers and Stafford to Portland. The rock in the quarry is a quite massive, medium-grained biotite granite. The more massive variety is seen in the small quarries north of East Glastonbury. It is light colored and is used for curbing in Hartford.

The best exposures of Monson granite is found in the quarries in the Connecticut River. At Arnold's Station is the town of Haddam, quarries have long been worked on a high hill near the station. The stone has been used for curbs and block pavements, also for buildings. It is a fine-grained, dark gray, uniform biotite-hornblende gneiss. Across the river at Haddam Neck several quarries have been opened on the hills facing the river. Extending through the towns of Woodstock and Eastford to Chaplin is a ridge a little over two miles in width. It is light or dark gray. The eastern border of the State from East Killingly, southward, is occupied by an area of granite, which has a further extension northward to Rhode Island and Massachusetts. Its color is pink to red, although in some regions it is light to medium gray. There is a quarry at Oneco in Sterling. In the region from Westerly to Groton there are large dikes of fine Westerly granite which have been quarried at several places. At Westerly, both the fine Westerly and the Sterling, or "red Westerly" granite are quarried, but the amount of the Sterling granite is much less than that of the famous fine-grained Westerly.

In Canterbury granite extends for a distance of fifteen miles through Pomfret, Brooklyn, Hampton and Canterbury. In the region of Westminister it has been quarried, and it seems to be quite suitable for flagging and rough stone work. The Maromas granite occupies both sides of the Connecticut River. The Haddam granite

is light-colored and fine-grained. The Branford granite, which occupies a narrow area along the shore of the sound, is medium-grained and of a pinkish tint. Along the shore from Haycock Point to West River in Guilford is found the Stony Creek granite, but in general the work is too broken to be of great value for quarrying, although there are a number of localities where it is sufficiently massive to make good building material. Covering portions of the towns of Lynn, Old Lynn, and East Lynn is found the Lynn granite. There are quarries at Rocky Point and on Rocky Neck. The New London stone is quite largely used locally for foundations of buildings. It is very coarse-grained and composed mostly of pale red or flesh-colored feldspar.

Along the eastern Connecticut shore line and extending into Rhode Island are found a number of exposures of gray and pink granite. This rock is quarried at several places, but particularly at Westerly and Niantic, Rhode Island, just east of the Connecticut line, whence the formation receives its name. Smaller quarries have been opened west of Pawcatuck River in Stonington. Of late years these localities have furnished large quantities of rock for building and especially monumental work.

#### RHODE ISLAND.

At Westerly two varieties of rock are quarried: a finely crystalline, gray rock, which shows minor variations in color and texture, but which is petrographically the same, and which is the Westerly granite of commerce, and a light red, coarse granite (the Sterling granite-gneiss), which somewhat resembles the rock from Stony Creek, but is much finer. The small quarries in Mystic and Groton furnish a gray variety, although the rock from the latter place is somewhat coarser than the typical Westerly. The Waterford and Millstone Point quarries yield stone which is almost identical with the Westerly.

Where typically exposed the Westerly granite is massive, with no indication of gneissoid structure; it is, however, cross-jointed and broken into blocks. Quartz, biotite, and a small amount of muscovite are the chief minerals composing the rock, hornblende being entirely absent. In the Westerly quarries small spots of a black, pitchy material, probably allanite, occasionally occur, giving the rock the local name of "bedbug granite." The variation in color from red to bluish gray seems to be caused by the variation in degree of oxidation. It takes a firm polish and is justly esteemed as one of the

best monumental granites in the country. One variety is decidedly pinkish in color, the others gray, fine and coarse-grained. All of good quality. There are also red, white and blue varieties.

THE FIRM OF JOSEPH NEWALL & Co., Westerly, R. I., although established in 1885, is really a continuation, or perhaps better termed a branch, of D. H. & J. Newall, Dalbeattie, Scotland. This firm was established in Dalbeattie in 1820 by David, Homer and Joseph Newall.

They made a specialty of Grey Dalbeattie and Red Peterhead granites, and for many years did a large export business to this country.

In 1885 the present branch came to this country and purchased a quarry at Niantic, R. I., where, with David McG. Newall as manager, they began manufacturing. They were as successful in their new field as they had been in the old. In entering the new field they set their motto as "Newall Quality" absolutely the best anyone was capable of producing, and it has always been their ambition to keep this standard keyed to the highest pitch.

Twelve years ago they moved their cutting plant to Westerly and erected their modern sheds, which are just off Oak street, along the main line of the New York, New Haven & Hartford R. R. Their plant is equipped with the latest improved machinery and appliances necessary for carrying on their business.

From their quarry at Niantic, R. I., is obtained their celebrated Blue White Westerly granite, a granite that has no superior for monumental and mausoleum work.

It would require several pages to enumerate the more notable mausoleums and monuments cut by this firm, but the following is a representative list: Peter A. B. Widener, William L. Elkins, Robert D. Carson and the James P. McNicol mausoleums in Philadelphia, and monuments for Senator Thomas C. Platt, New York, and John Sherman of Ohio. The Cornelius Harrigan monument in process of construction is probably the largest monument ever cut in Westerly granite. Some idea as to the size of this monument may be obtained when the lower base is 15-6 by 10-6 and the die of the monument is cored out to receive two caskets.

David McG. Newall is a member of the Franklin Lodge, A. F. & A. M., and is a K. T. of the Narragansett Commandary.

ELIA MONTI, Westerly, R. I., proprietor of the Columbia Granite Co., was born in Italy, February, 1877, and in 1890 went to Quincy, Mass., where he worked ten years. He then went to Westerly and engaged in business in a plant near his present quarters, where he remained three years. He bought the shed he now occupies from the Westerly Granite Co., and some time later his son, John, was admitted to the firm. They do all kinds of cemetery work for the trade.

## CHAPTER X.

MAKING PAVING BLOCKS.—VARIOUS KINDS AND SIZES OF PAVING  
USED IN THE UNITED STATES.

**A**N interesting adjunct to the granite business is the making of paving blocks. Experience has shown that streets subjected to heavy traffic wear best when paved with stone. All stones, however, are not suited to this use, some being too soft, thus wearing away quickly, and others too hard, and so becoming smooth and slippery under usage. The qualities desired in a good paving stone are hardness and brittleness, and certain of the granites have been found to answer this requirement perfectly. Nearly all the quarries turn out more or less of these blocks, the broken or waste stone being worked up in that way. Some entire quarries, notably those in Maine, are devoted to this one thing. For years the enterprise was a growing one, the paving block manufactured in 1889 aggregating 62,000,000. The chief skill required in the making of the blocks is an ability to see quickly and to take advantage of the direction of cleavage. The tools used are principally hammers of various kinds for opening and breaking the stone. There are no uniform standards of size, the blocks varying from 3 1-4 to 4 1-2 inches in width, 6 to 7 inches in depth, and 8 to 12 inches in length. In general, the Eastern cities prefer the larger sized blocks, while the western and southern cities like the smaller. New Orleans is an exception to this last, however, using on account of the peculiar nature of its streets, the largest size. The cutters are usually paid by the piece for making the blocks, receiving from \$20 to \$30 a thousand for them. The variation is due largely to whether the workmen furnish their own tools and quarry their own granite, or receive the rough stone from their employees. The finished blocks sell in the large centres for from forty to seventy, and sometimes ninety dollars a thousand. Assuming that \$60 is a fair average price, the value of the output for granite paving blocks in 1889 would reach \$3,720,000.

The paving of the public thoroughfares of Boston seems to have begun at a very early period. Jossley, describing Boston in 1663, says most of the streets "are paved with pebble," meaning the

smooth, round stones from the beach. It was not the practice at first to pave the whole width of the street, but only a strip in the middle; the "Neck" leading to Roxbury was so paved. In the same manner the sidewalks were paved with cobblestones, bricks, or flags, of only width enough for a single passenger; in some instances when flagstones were used, the remaining space was filled with cobblestones. It is probable that the first paving was done in a fragmentary way before 1700, but in 1703-04, the town voted £100 for this purpose, "as the selectmen shall judge most needful, having particular regard for the highway nigh old Mrs. Stoddard's house." An order for paving 42 rods of Orange (Washington) street was made in 1715. From this time sums were regularly voted, and the foundation laid for the most cleanly city in America.

A lady who came to Boston in 1795 from New York and was much struck with the quaint appearance of the town, wrote: "There were no brick sidewalks, except in a part of the main street (Washington), near the Old South, then called Cornhill. The streets are paved with pebbles; and, except when driven on one side by carts and carriages, everyone walked in the middle of the street where the pavement was the smoothest."

On July 30, 1774, the town of Boston voted to allow the pavers employed in repairing the public streets eight pence (16 cents) per yard for paving, and the laborers two shillings and eight pence (about 64 cents) per day, and those who pick up the stones 20 pence (40 cents) per day. In 1819, the pavers did their work so unskilfully that the town voted that no workmen should be employed who had not been approved by the Board of Selectmen.

May 1, 1811, it is entered in the minutes of the Selectmen of Boston that "notice was received from the directors of the Mill Pond Corporation, that they should find it necessary to make an opening immediately through the causeway for the purpose of admitting lighters with stone, to build the walls of the canal." These lighters and boats were under the watchful eyes of an official inspector, whose duty it was to regulate their carrying capacity and to weigh each boat. The fee was six dollars when the weight did not exceed 24 tons, and 25 cents for each additional ton. They were also allowed one dollar for inspecting annually the marks on any such boat or lighter.

In 1840 Solomon Willard laid the first paving blocks of Quincy granite in front of the Tremont House; they were very large at first—18 inches by 14 feet—but were decreased in size until they were

about a foot square. For a while (1856) blocks of trap stone from Bergen Hill, New Jersey, were used, until in 1858, Henry Barker of Quincy introduced the small granite pavers, which have since been generally used. The supply comes from various quarries throughout New England.

Somewhere about the year 1850, Court street, Boston, between Washington street and Court House square was paved with iron. Octagon-shaped shells about nine inches across, five inches high, with cross sections, on which, as well as the outer shell, were oval projections the shape of the blocks or shells. These blocks fitted each other so as to make a complete pavement. The interstices were filled with a broken stone concrete. At the price of iron in those days it must have been very expensive.

Sidewalks were flagged or paved in the last century. Before the North river flagging came into use in Boston, quantities of the Bolton, Connecticut, flagging (a mica-schist, wearing down easily) were laid down. Many of the business streets were flagged with North river stone and granite flags, the granite principally from Quincy and Rockport. For crossings, North river stone and granite, a great deal of the granite came from the old-fashioned paving blocks. For the catch basins of the sewers, Rockport granite was largely employed.

In 1852, cubical blocks were popular in some cities, particularly in Philadelphia. These, although unsurpassed in regard to solidity and durability, soon came to be objectionable, since the surface of the large blocks wore smooth, and hence afforded but an uncertain foothold for horses. This difficulty was sought to be remedied by using small (Belgian) blocks four inches square, and a secure foothold for horses was thus obtained. But experience soon proved that with a width of about four inches the length of the block might be increased to a foot or more, thus securing a more solid pavement without sacrificing any other merit.

In New York City many experiments were made in reference to the selection both of the best material and most satisfactory shape. Broadway probably tests pavements more severely than any other street in the world. For cobblestone pavement, boulders and large pebbles from the till of the island were employed. But it was found that the pointed ends of the cobblestones, lying downward, had a tendency to sink unequally under heavy pressure, and that consequently hollows formed in the pavement rendered the roadway impassable. The Russ pavement was first laid about the year

1853. It became smooth and slippery by uninterrupted travel. It consisted of large square granite blocks, sometimes grooved, and they answered temporarily, but the grooves were found to wear smooth at their edges. An attempt to groove the blocks already laid down led to the discovery that the surface of these stones had, by constant rubbing with iron horseshoes and wagon tires, aided by atmospheric action, undergone such a physical (or chemical) change that the hardest steel tools could not cut the grooves, consequently the effort had to be abandoned. In order to increase the durability of the Russ pavement it was constructed in two layers in some portions of Broadway, the lower consisting of large, irregular, angular pieces of rock laid in the earth. Elsewhere large flag stones were laid below, then a layer of earth, and then the large blocks of traps or granite. However, the result was unsatisfactory. The whole of the pavement was broken up and the blocks split into smaller cubical pieces for use in Belgian pavement elsewhere. Wood, concrete and asphalt have also been used in various combinations, and trap has been crushed and broken for use in macadamizing.

The use of stone for macadam is largely a development of the past fifty years, and the demand for it for this purpose has caused the great increase in the number of quarries of trappean rock. This demand for crushed stone also enables the quarries worked mainly for building or monumental stone to dispose of a part of their waste. The material used for macadam depends, however, to a considerable extent on the kind of rock that is available in neighboring sources.



